

# Reflexomat with Basic controller

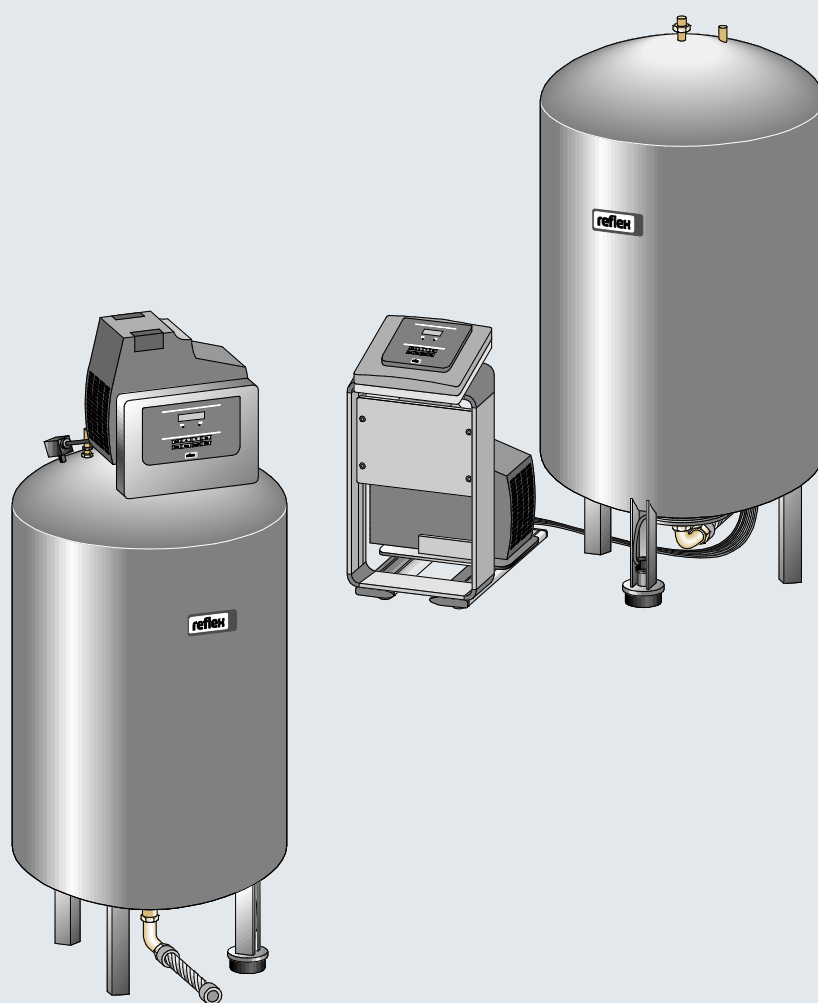
Reflexomat RS 90 / 1

Reflexomat Compact RC

GB

## Operating manual

Original operating manual





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## 1 Notes on the operating manual

This operating manual is an important aid for the safe and reliable function of the device.

The operating manual is intended to:

- Avert dangers to personnel.
- Understand the device.
- Obtain optimal functioning.
- Early identify and rectify problems.
- Avoid faults caused by improper use.
- Prevent repair costs and downtimes.
- Increase reliability and service life.
- Prevent damage to the environment.

Reflex Winkelmann GmbH cannot accept any liability for damage caused by ignoring this operating manual. In addition to this operating manual, you must comply with national legislation and regulations in the country of use (accident prevention, environment protection, save and proper work, etc.).

This operating manual describes the device with basic equipment and interfaces for optional equipment with additional functions. For optional equipment and accessories, see chapter 4.6 "Optional equipment and accessories" on page 14 .



### Notice!

Every person installing this equipment or performing any other work at the equipment is required to carefully read this operating manual prior to commencing work and to comply with its instructions. The manual is to be provided to the device operator and must be stored near the device for access at any time.

## 2 Liability and guarantee

The product is manufactured to the latest engineering standards and acknowledged safety regulations. Nevertheless, risk of injury and death for the user and other parties and damage to the system and other property can arise from its use.

Modifications of the device such as changes of the hydraulic system or interference with the interconnection are strictly prohibited.

The liability and guarantee of the manufacturer are excluded when the malfunction can be traced back to one or more of the following causes:

- Improper use of the device.
- Improper commissioning, operation, maintenance, servicing, repair, and installation of the device.
- Ignoring the safety notes in this operating manual.
- Device operation with defective or improperly installed safety and/or protective equipment.
- Failure to perform maintenance and inspection work at due times.
- Use of unauthorised replacement parts and accessories.

The precondition for any guarantee claims is the proper installation and commissioning of the device.



### Notice!

Have the Reflex Customer Service carry out commissioning and the annual maintenance, see chapter 11.1 "Reflex Customer Service" on page 61 .

### 3 Safety

#### 3.1 Explanation of symbols

##### 3.1.1 Symbols and notes used

The following symbols are used in this operating manual.



#### Danger

- Danger to life and/or severe damage to health
  - The corresponding warning symbol in combination with the "Danger" signal term indicates an imminent threatening danger which will result in death or severe (irreversible) injuries.



#### Warning

- Severe damage to health
  - The corresponding warning symbol in combination with the "Warning" signal term indicates a threatening danger which may result in death or severe (irreversible) injuries.



#### Caution

- Damage to health
  - The corresponding warning symbol in combination with the "Caution" signal term indicates a danger which may result in minor (reversible) injuries.



#### Attention!

- Damage to property
  - This symbol in combination with the "Attention" signal word indicates a situation that may cause damage to the product itself or objects in its vicinity.



#### Notice!

This symbol in combination with the "Notice" signal word indicates useful tips and recommendations regarding the efficient use of the product.

##### 3.1.2 Safety symbols used

The following safety symbols are used in this operating manual. They are also attached to the equipment or in its vicinity.



This symbol warns of electric voltage.



This symbol warns of a hot surface.



This symbol warns of overpressure in conduits and connections.

### 3.2 Personnel requirements

Only specialist personnel or specifically trained personnel may install and operate the equipment.

The electric connections and the wiring of the device must be executed by a specialist in accordance with all applicable national and local regulations.

### 3.3 Personal protective equipment

When working at the system, wear the stipulated personal equipment such as hearing and eye protection, safety boots, helmet, protective clothing, protective gloves.



See the national regulation of your country for personal protective equipment required.

### 3.4 Intended use

The device is a pressure maintaining station for heating and cooling water systems. It is intended to maintain the water pressure and to add water within a system. The devices may be used only in systems that are sealed against corrosion and with the following water types:

- Non-corrosive
- Chemically non-aggressive
- Non-toxic

The ingress of atmospheric oxygen by permeation into the entire heating and cooling water system, make-up water and similar must be reliably minimised during operation.

### 3.5 Inadmissible operating conditions

The devices are not suited for the following conditions.

- In mobile system operation
- For outdoors operation
- For the use with mineral oils
- For the use with flammable media
- For the use with distilled water



#### Notice!

Changes to the hydraulic system or interference with the interconnection are strictly prohibited.

### 3.6 Residual risks

This device has been manufactured to the current state of the art. However, some residual risk cannot be excluded.



#### Caution – risk of burning!

- Excessive surface temperatures in heating systems can cause skin to burn.
  - Wait until surfaces have cooled down or wear protective gloves.
  - The operator is required to attach corresponding warning notes in the device vicinity.



#### Caution – risk of injury!

- Incorrect installation or service work may cause burns and other injuries at the connections when hot water or steam suddenly escape at pressure.
  - Ensure proper installation.
  - Ensure that the system is de-pressurised before performing service work at the connections.



#### Warning – large weight!

- The devices are very heavy. Thus, there is a risk of physical damage and accidents.
  - Use only lifting gear suitable for transport and installation.



## 4 Description of the device

### 4.1 Description

The Reflexomat is a compressor-controlled pressure maintaining station for heating and cooling water systems. The Reflexomat essentially comprises a controller and at least one expansion tank. The additional connection of secondary tanks is optionally possible. The expansion tank is fitted with a diaphragm to divide the tank into an air space and a water space, preventing the ingress of atmospheric oxygen into the expansion tank.

The Reflexomat provides the following safety features:

- Optimisation of pressure maintenance and make-up.
  - No direct intake of air thanks to a regulation of the pressure maintenance and optional automatic make-up.
  - No circulation issues caused by free bubbles in the circuit water.
  - Reduced corrosion damage due to oxygen removal from make-up water.

The Reflexomat is offered in two variants:

- Reflexomat Compact RC
  - One "RG" primary tank as expansion tank with up to 600 litres nominal volume.
  - The compact control unit is factory-installed on the primary tank.
  - All electric and air connections between control unit and expansion tank are pre-installed.
- Reflexomat RS 90 / 1
  - One "RG" primary tank as expansion tank with up to 600 litres nominal volume.
    - The RS 90 / 1 compact control unit is factory-installed on the primary tank.
    - All electric and air connections between control unit and expansion tank are pre-installed.
  - "RG" primary tank with a nominal volume from 800 litres.
    - The RS 90 / 1 control unit as stand-alone console.
  - The connection of "RF" secondary tanks to the primary tank is optionally possible.

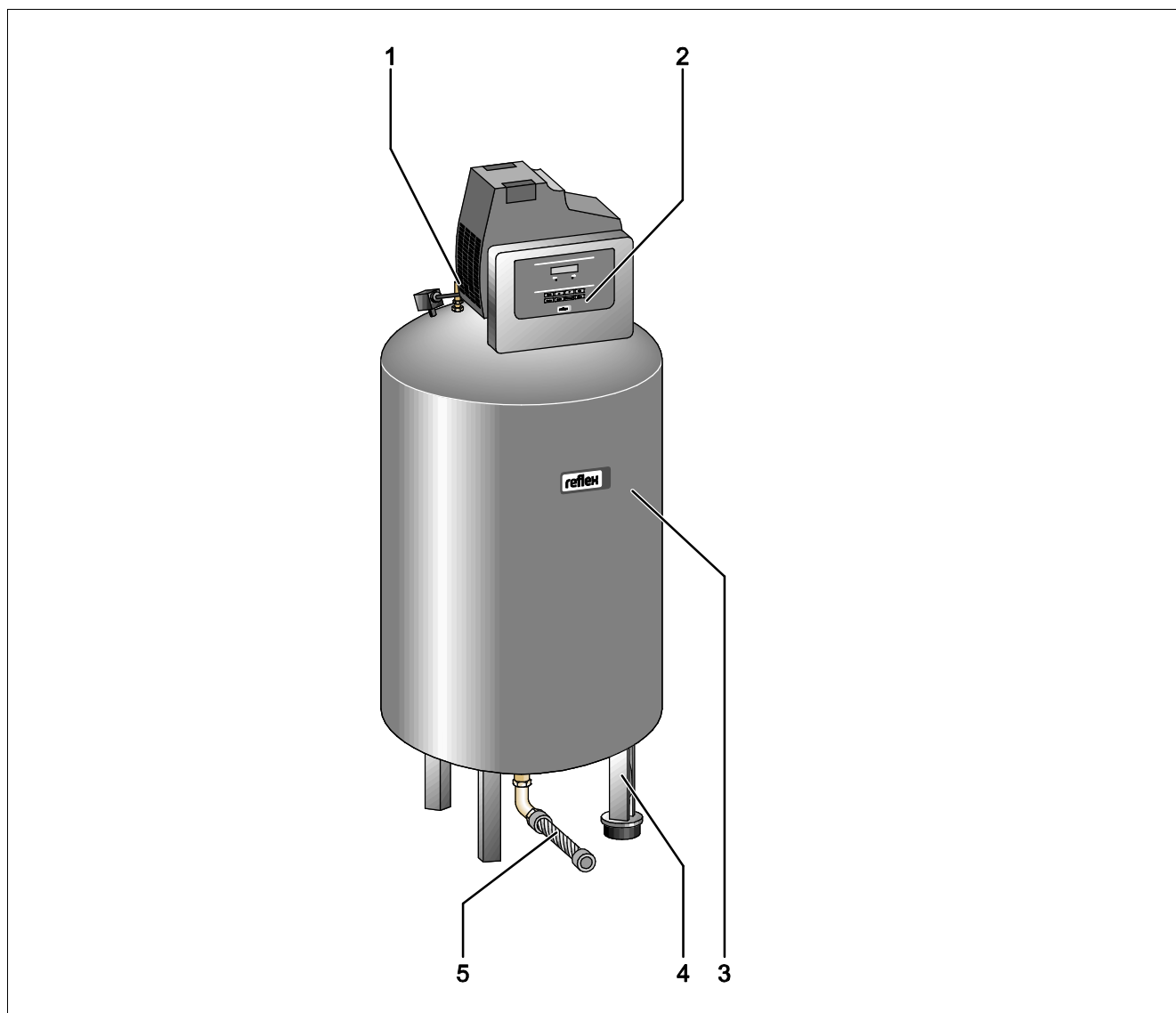


#### **Notice!**

It is not possible to connect secondary tanks to the Reflexomat Compact "RC".

## 4.2 Overview

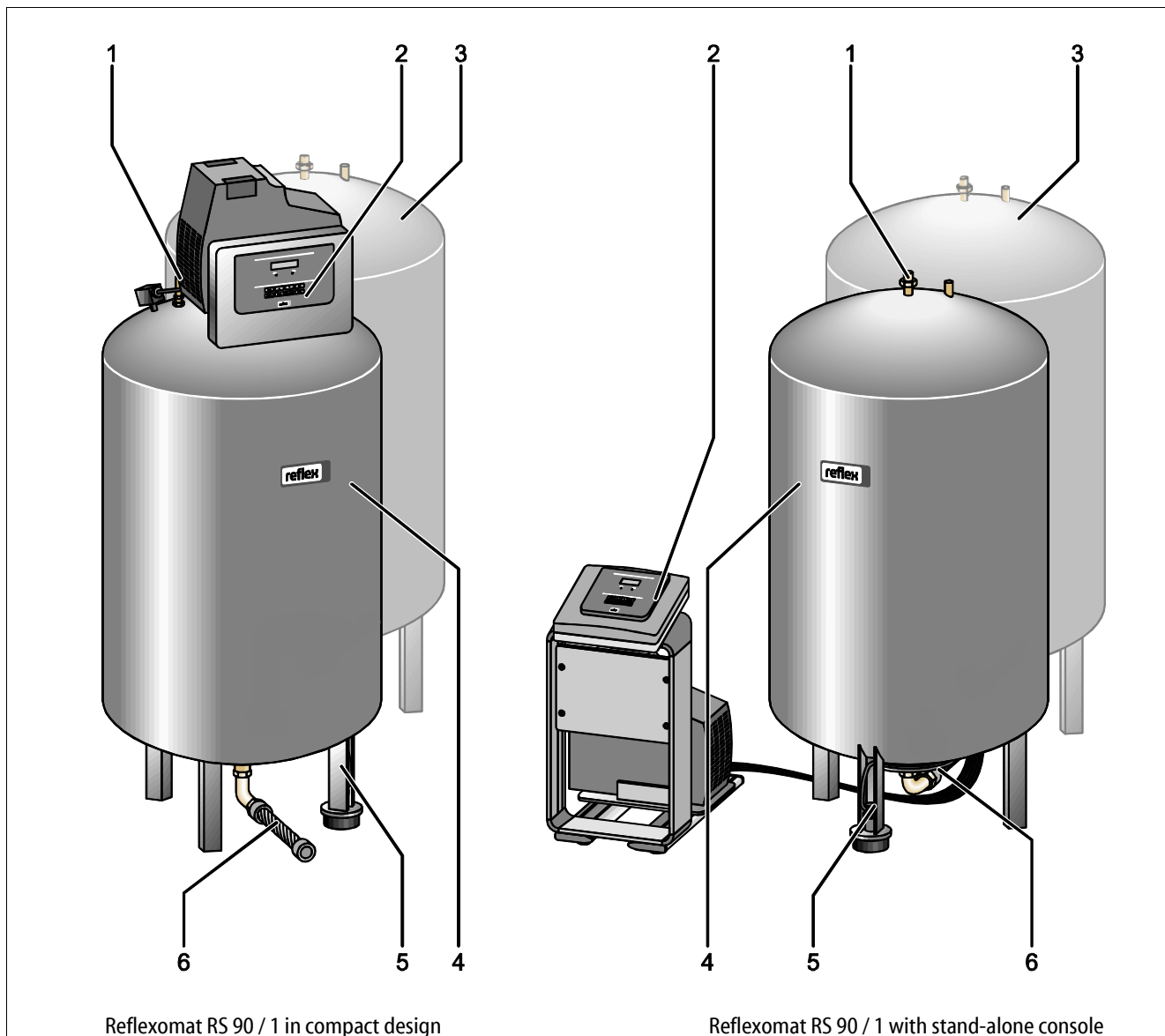
### 4.2.1 Reflexomat Compact RC



1	"SV" safety valve
2	"RC" control unit <ul style="list-style-type: none"> <li>• Compressor</li> <li>• "Reflex Control Basic" controller</li> </ul>
3	"RG" primary tank

4	"LIS" level sensor
5	"EC" expansion line

4.2.2 Reflexomat RS 90 / 1



1	"SV" safety valve
2	"RS 90 / 1" control unit <ul style="list-style-type: none"> <li>• Compressor</li> <li>• "Reflex Control Basic" controller</li> </ul>
3	"RF" secondary tank (optional)

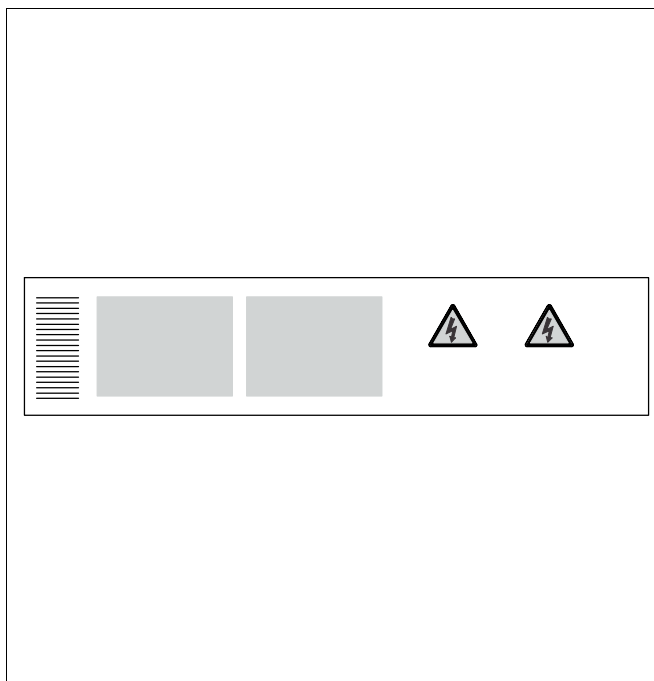
4	"RG" primary tank
5	"LIS" level sensor
6	"EC" expansion line

### 4.3 Identification

#### 4.3.1 Nameplate

The nameplate provides manufacturer information, year of manufacture, serial number, and technical data.

Information on nameplate	Meaning
Type	Device name
Serial No.	Serial number
min. / max. allowable pressure P	Minimum/maximum permissible pressure
max. continuous operating temperature	Maximum temperature for continuous operation
min. / max. allowable temperature / flow temperature TS	Minimum/maximum permissible temperature/TS flow temperature
Year built	Year of manufacture
min. operating pressure set up on shop floor	Factory-set minimum operating pressure
at site	Set minimum operating pressure
max. pressure safety valve factory - a line	Factory-set opening pressure of the safety valve
at site	Set opening pressure of the safety valve

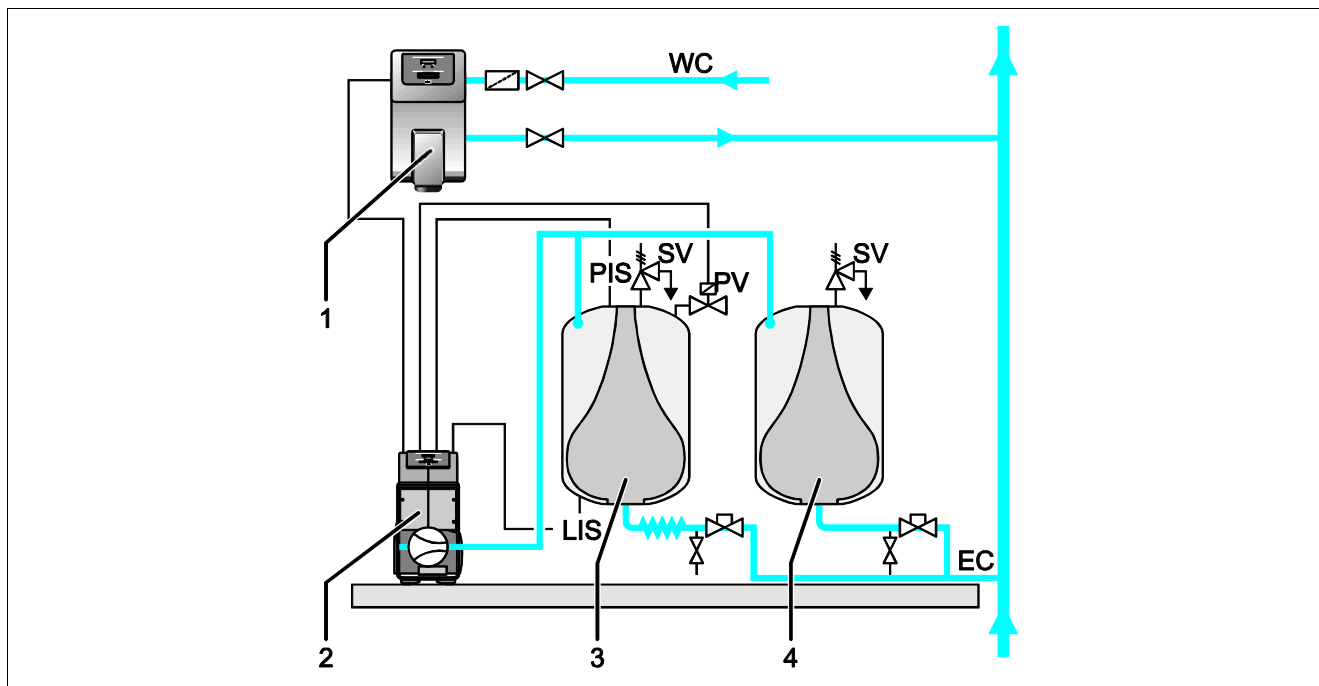


#### 4.3.2 Type code

No.		Reflexomat Compact RC type key
1	"RC" control unit	Reflexomat RC 500 1 2
2	Primary tank nominal volume	

No.		Reflexomat RS 90 / 1 type key
1	Control unit designation	Reflexomat RS 90 / 1, RG 1000 I, RF 1000 I 1 2 3 4 5 6
2	Number of compressors	
3	"RG" primary tank	
4	Nominal volume	
5	"RF" secondary tank	
6	Nominal volume	

## 4.4 Function



1	Water make-up with "Fillcontrol Auto"
2	RS 90 / 1 control unit
3	Primary tank as expansion tank
4	Secondary tank as additional expansion tank
WC	Make-up line

PIS	Pressure sensor
SV	Safety valve
PV	Overflow solenoid valve
LIS	Pressure pick-up
EC	Expansion line

### Expansion tanks

One primary tank and multiple optional secondary tanks may be connected. Diaphragms separate the tanks' interiors in an air and a water space, preventing the ingress of atmospheric oxygen into the expansion water. The primary tank and the "LIS" level monitoring are connected to the control unit at the air side and to the facility system at the water side. The pressure is protected at the air side by the "SV" safety valves of the tanks.

### Control unit

The control unit contains the "CO" compressor and the controller. The "PIS" pressure transducer records the pressure and the "LIS" pressure pick-up registers the level; both values are displayed at the controller.

### Maintaining pressure

The pressure in the system rises when the water is heated. If the air pressure set at the controller is exceeded, the "PV" overflow solenoid valve opens and discharges air from the primary tank. This allows water to flow into the primary tank and the water pressure within the system drops. The water pressure in the system drops when the water cools. When the air pressure drops below the set value, the "CO" compressor cuts in and delivers air into the primary tank, displacing the water in the primary tank. The water pressure in the system rises.

### Make-up

The addition of more water is controlled within the controller. When the water level falls below the minimum in the primary tank, the "LIS" pressure pick-up sends a signal to the controller. The controller actuates an external make-up device. Water is directly added into the system in a controlled manner by monitoring the make-up time and the make-up cycles.



### Notice!

For optional equipment for water make-up, see chapter 4.6 "Optional equipment and accessories" on page 14 .

## 4.5 Scope of delivery

The scope of delivery is described in the shipping document and the content is shown on the packaging.

Immediately after receipt of the goods, please check the shipment for completeness and damage. Please notify us immediately of any transport damage.

Basic pressure-maintaining equipment:

- Reflexomat Compact RC
  - One primary tank and one compact control unit.
- Reflexomat RS 90 / 1
  - One primary tank up to 600 litres and one compact control unit.
  - One primary tank from 800 litres and one stand-alone control unit.
- "LIS" pressure pick-up for level sensing.

Optional basic equipment for Reflexomat RS 90 / 1:

- Secondary tanks with flexible connection sets for the connection to the primary tank.

## 4.6 Optional equipment and accessories

- For make-up with water.
  - Make-up without pump:
    - Solenoid valve with ball valve and Reflex Fillset for make-up with potable water.
  - Make-up with pump:
    - Reflex Fillcontrol Auto, with integrated pump and a system separation vessel.
- For water make-up and degassing:
  - Reflex Servitec 30 (25)
  - Reflex Servitec 35-95
- Reflex Fillset for make-up with water.
  - With integrated system separator, water meter, dirt trap and locking mechanisms for the "WC" make-up line.
- Reflex Fillset Impulse with FQIRA+ contact water meter for make-up with water.
- Reflex Fillsoft for softening the make-up water from the public water network.
  - Reflex Fillsoft is installed between Reflex Fillset and the device. The device controller evaluates the make-up quantities and signals a required replacement of the softening cartridges.
- Enhancements for the device controller:
  - I/O module for standard communication.
  - Master-Slave-Connect for master controllers for maximum 10 devices.
  - Bus modules:
    - Lonworks Digital
    - Lonworks
    - Profibus DP
    - Ethernet
- Optional diaphragm rupture indicator, only for Reflexomat RS 90 / 1.



### Notice!

Separate operating instructions are supplied with accessories.

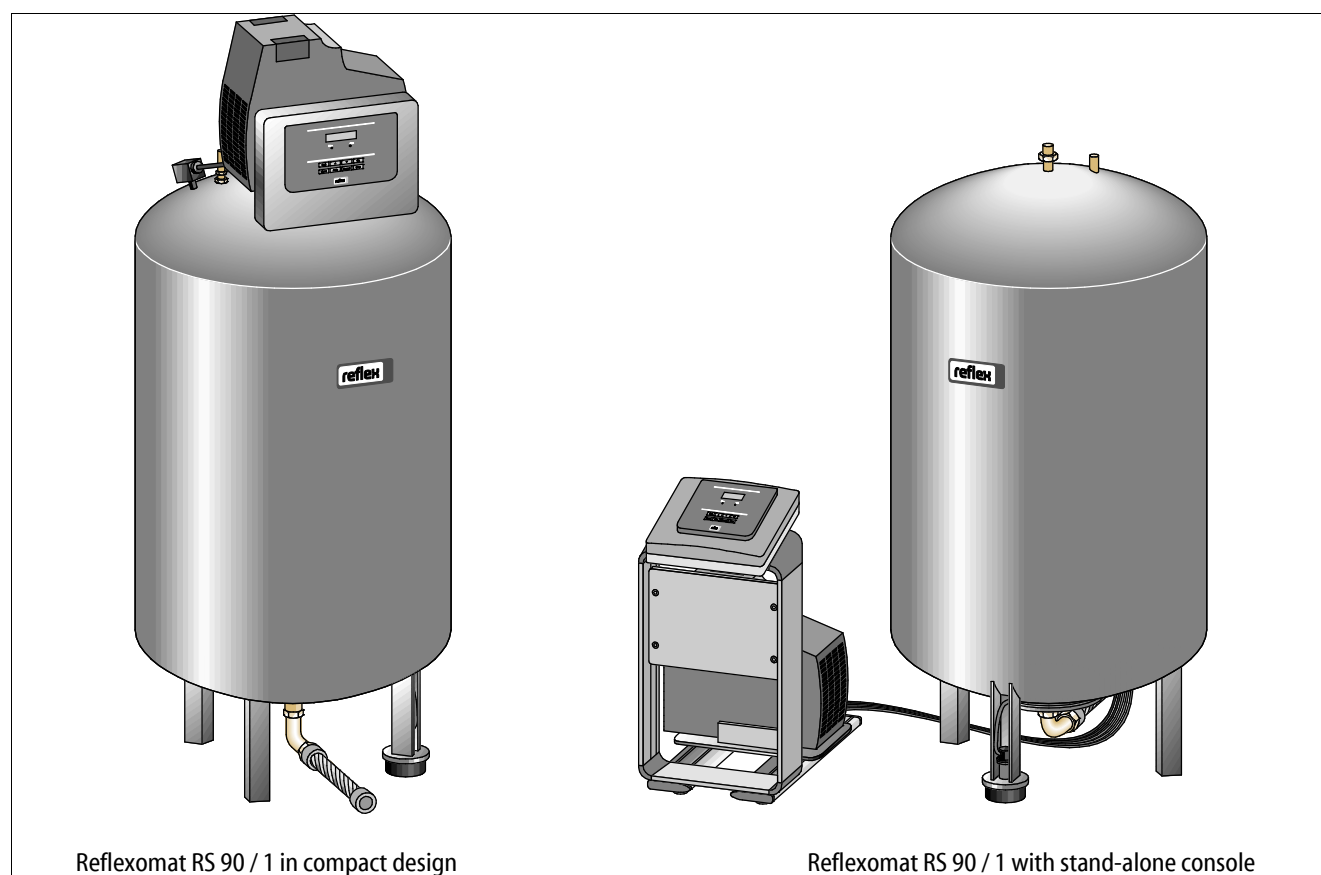
## 5 Technical data

### Reflexomat Compact RC



Type	RC 200	RC 300	RC 400	RC 500
Part No.	8806405	8801705	8802805	8803705
Noise level	72 dB	72 dB	72 dB	72 dB
Electric output	0.75 kW	0.75 kW	0.75 kW	0.75 kW
Voltage	230 V	230 V	230 V	230 V
Frequency	50 Hz	50 Hz	50 Hz	50 Hz
Power Supply	Plug	Plug	Plug	Plug
Degree of protection	IP 54	IP 54	IP 54	IP 54
Diameter	634 mm	634 mm	740 mm	740 mm
Height	1320 mm	1620 mm	1620 mm	1845 mm
Weight	52 kg	69 kg	80 kg	93 kg
Mechanical connection in inches	R1	R1	R1	R1
Diaphragm to DIN 4807 T3	Fully installed	Fully installed	Fully installed	Fully installed
Permissible gauge working pressure	6 bar	6 bar	6 bar	6 bar
Permissible flow temperature	120 °C	120 °C	120 °C	120 °C
Permissible operating temperature	70 °C	70 °C	70 °C	70 °C
Permissible ambient temperature	0 °C – 45 °C	0 °C – 45 °C	0 °C – 45 °C	0 °C – 45 °C

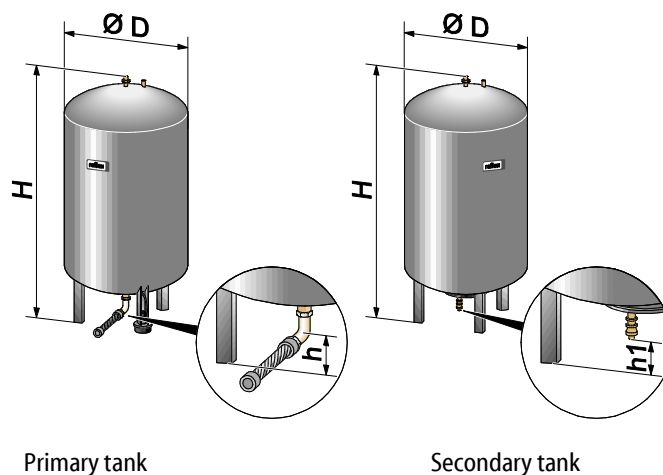
## Reflexomat RS 90 / 1



### Control unit

Type	RS 90 / 1 in compact design	RS 90 / 1 with stand-alone console
"RG" primary tank volume	Up to 600 litres	From 800 litres
Part No.	8880111	8880211
Noise level	72 dB	72 dB
Electric output	0.75 kW	0.75 kW
Voltage	230 V	230 V
Frequency	50 Hz	50 Hz
Power Supply	Plug with 5 metre cable	Plug with 5 metre cable
Degree of protection	IP 54	IP 54
Width	395 mm	395 mm
Depth	520 mm	345 mm
Height	415 mm	585 mm
Weight	21 kg	25 kg
Diaphragm to DIN 4807 T3	Exchangeable	Exchangeable
Permissible gauge working pressure	6 bar, 10 bar	6 bar, 10 bar
Permissible flow temperature	120 °C	120 °C
Permissible operating temperature	70 °C	70 °C
Permissible ambient temperature	0 °C – 45 °C	0 °C – 45 °C



**Tanks**


6 bar type	200	300	400	500	600	800	1000
Primary tank, Article No.	8799100	8799200	8799300	8799400	8799500	8799600	8650105
Secondary tank, Article No.	8789100	8789200	8789300	8789400	87894500	87894600	8652005
Diameter $\varnothing$ "D"	634 mm	634 mm	740 mm	740 mm	740 mm	740 mm	1000 mm
Height "H"	970 mm	1270 mm	1255 mm	1475 mm	1720 mm	2185 mm	2025 mm
Height "h"	115 mm	115 mm	100 mm	100 mm	100 mm	100 mm	195 mm
Height "h1"	155 mm	155 mm	140 mm	140 mm	140 mm	140 mm	305 mm
Height "H <sub>G</sub> " *	1350 mm	1650 mm	1640 mm	1860 mm	2110 mm	—	—
Weight	37 kg	54 kg	65 kg	78 kg	94 kg	149 kg	156 kg
Connection	R1	R1	R1	R1	R1	R1	DN65

6 bar type	1500	2000	3000	4000	5000
Primary tank, Article No.	8650305	8650405	8650605	8650705	8650805
Secondary tank, Article No.	8652205	8652305	8652505	8652605	8652705
Diameter $\varnothing$ "D"	1200 mm	1200 mm	1500 mm	1500 mm	1500 mm
Height "H"	2025 mm	2480 mm	2480 mm	3065 mm	3590 mm
Height "h"	185 mm	185 mm	220 mm	220 mm	220 mm
Height "h1"	305 mm	305 mm	334 mm	334 mm	334 mm
Height "H <sub>G</sub> "	—	—	—	—	—
Weight	465 kg	565 kg	795 kg	1080 kg	1115 kg
Connection	DN65	DN65	DN65	DN65	DN65

\* Height including control unit on tank

10 bar type	350	500	750	1000	1500	2000	3000
Primary tank, Article No.	8654000	8654100	8654200	8651005	8651205	8651305	8651505
Secondary tank, Article No.	8654300	8654400	8654500	8653005	8653205	8653305	8653505
Diameter Ø "D"	750 mm	750 mm	750 mm	1000 mm	1200 mm	1200 mm	1500 mm
Height "H"	1340 mm	1600 mm	2185 mm	2065 mm	2055 mm	2515 mm	2520 mm
Height "h"	190 mm	190 mm	180 mm	165 mm	165 mm	165 mm	195 mm
Height "h1"	190 mm	190 mm	180 mm	285 mm	285 mm	285 mm	310 mm
Height "H <sub>G</sub> " *	–	–	–	–	–	–	–
Weight	230 kg	275 kg	345 kg	580 kg	800 kg	960 kg	1425 kg
Connection in inches	R1	R1	R1	R1	R1	R1	DN65

10 bar type	4000	5000
Primary tank, Article No.	8651605	8651705
Secondary tank, Article No.	8653605	8653705
Diameter Ø "D"	1500 mm	1500 mm
Height "H"	3100 mm	3630 mm
Height "h"	195 mm	195 mm
Height "h1"	310 mm	310 mm
Height "H <sub>G</sub> " *	–	–
Weight	1950 kg	2035 kg
Connection in inches	DN65	DN65

\* Height including control unit on tank

## 6 Installation



### Danger – Electric shock!

- Serious injury or death due to electric shock.
  - Any system in which the device is to be installed must be de-energised.
  - Ensure that the system is locked and cannot be switched on by other personnel.
  - Installation work for the electric connection of the device must be carried out by an authorised electrician in compliance with electrical engineering regulations.



### Caution – risk of injury!

- Incorrect installation or service work may cause burns and other injuries at the connections when hot water or steam suddenly escape at pressure.
  - Ensure proper installation.
  - Ensure that the system is de-pressurised before performing service work at the connections.



### Caution – risk of burning!

- Excessive surface temperatures in heating systems can cause skin to burn.
  - Wait until surfaces have cooled down or wear protective gloves.
  - The operator is required to attach corresponding warning notes in the device vicinity.



### Caution – Risk of injury due to falls or bumps!

- Bruising from falls or bumps at system components during installation.
  - Wear personal protective equipment (helmet, protective clothing, gloves, safety boots).



### Warning – large weight!

- The devices are very heavy. Thus, there is a risk of physical damage and accidents.
  - Use only lifting gear suitable for transport and installation.



### Notice!

The proper installation and commissioning must be confirmed in the installation, commissioning and maintenance certificate. This certificate is prerequisite for any warranty claim.

- Have the Reflex Customer Service carry out commissioning and the annual maintenance.

## 6.1 Installation conditions

### 6.1.1 Incoming inspection

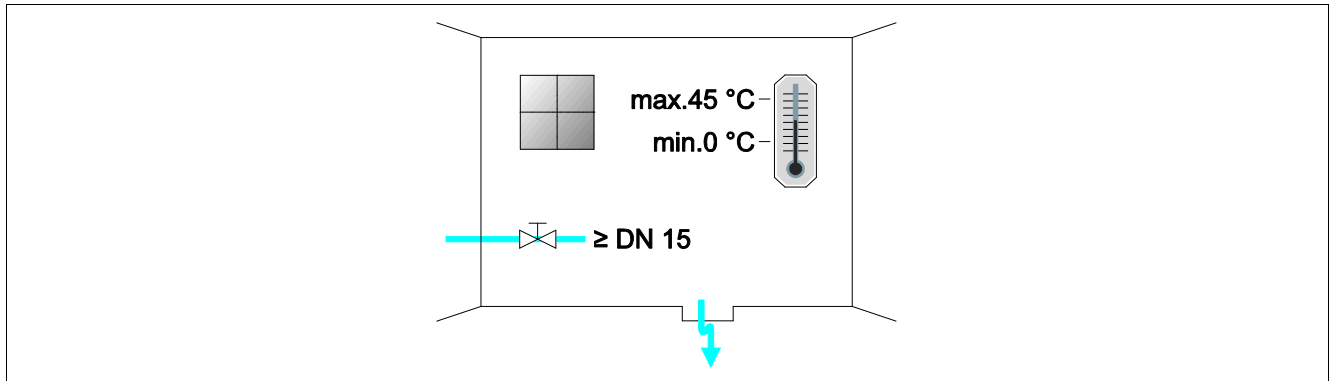
Prior to shipping, this device was carefully inspected and packed. Damages during transport cannot be excluded.



#### Notice!

After receipt of the goods, please check the shipment for completeness and damage. Document any transport damage. Contact the shipper to register a claim for damage.

## 6.2 Preparatory work



#### Conditions for the device installation:

- No access by unauthorised personnel.
- Frost-free, well ventilated room.
  - Room temperature 0 °C to 45 °C.
- Level, stable flooring.
  - Ensure sufficient bearing strength of the flooring before filling the tanks.
  - Ensure that the control unit and the tanks are installed on the same level.
- Filling and dewatering option.
  - Provide a DN 15 filling connection according to DIN 1988 T 4.
  - Provide an optional cold water inlet.
  - Prepare a drain for the drain water.
- Electric connection: 230 V~, 50 Hz, 16 A with upstream ELCB: Tripping current 0.03 A.
- Use only approved transport and lifting gear.
  - The load fastening points at the tanks must be used only as installation resources.

## 6.3 Execution



### **Attention! – Damage caused by improper installation**

- Remember that the connection of pipelines or equipment originating with the system may cause additional stresses to the device.
  - Ensure a stress-free installation of the pipe connections between the device and the overall system.

For installation, proceed as follows:

- Position the device.
- Complete the primary tank and the optional secondary tanks.
- Create the water-side connections of the control unit to the system.
- Create the interfaces according to the terminal plan.
- Install the water connections between optional secondary tanks to each other and to the primary tank.



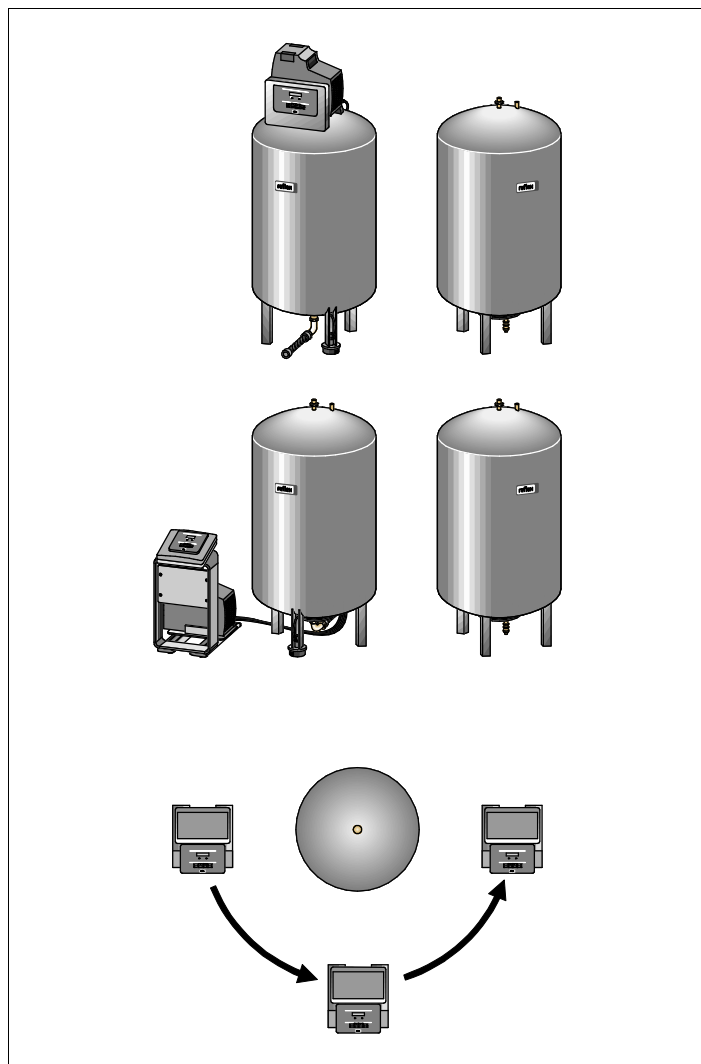
### **Notice!**

For installation, note the operability of the valves and the inlet options of the connecting lines.

### 6.3.1 Positioning

Determine the device position.

- Control unit
  - Primary tank
  - Optional secondary tank
- The control unit can be installed on either side or in front of the primary tank. The distance of the control unit to the primary tank results from the connection set supplied.

**Notice!**

Connecting secondary tanks is not possible with the Reflexomat Compact RC.

### 6.3.2 Tank installation

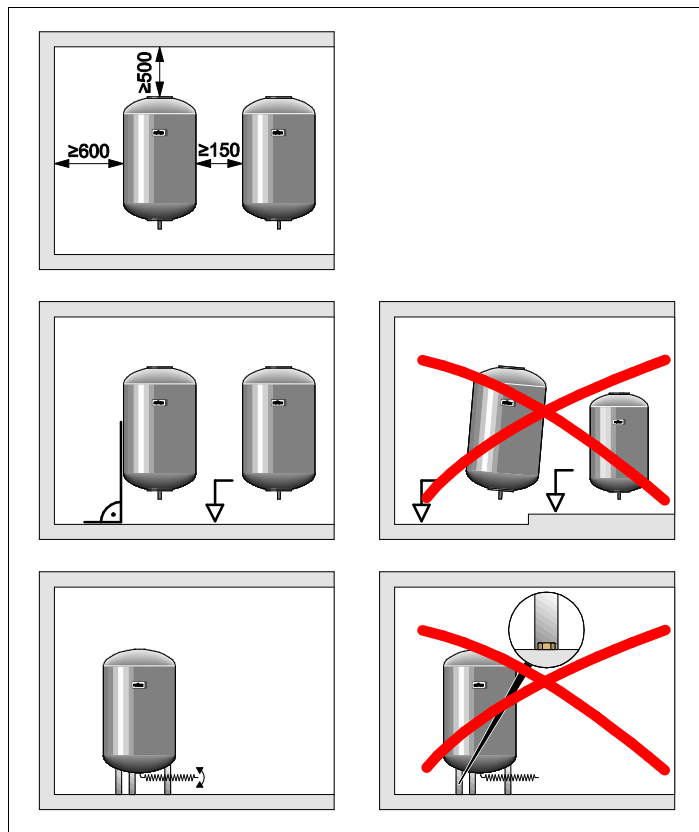


#### Attention! – Damage caused by improper installation

- Remember that the connection of pipelines or equipment originating with the system may cause additional stresses to the device.
  - Ensure a stress-free installation of the pipe connections between the device and the overall system.

Comply with the following notes regarding the installation of the primary tank and the secondary tanks:

- All flange openings at the tanks are viewing and maintenance openings. Install the primary tank and the secondary tanks, if provided, with sufficient spaces at the sides and the top.
- Install the tanks on a level plane.
- Ensure rectangular and free-standing position of the tanks.
- If you use secondary tanks in addition to the primary tank, ensure that all tanks have the same type and dimensions.
- Do not attach the tanks to the flooring to ensure the functioning of the "LIS" level sensor.
- Install the control unit on the same level as the tanks.



### 6.3.3 Connection to the facility system



#### **Caution – Risk of injury due to falls or stumbling!**

- Bruises caused by falls or stumbling over cables or pipes during installation.
  - Wear personal protective equipment (helmet, protective clothing, gloves, safety boots).
  - Ensure proper installation of cables and pipes between the control unit and the tanks.



#### **Attention! – Damage caused by improper installation**

- Remember that the connection of pipelines or equipment originating with the system may cause additional stresses to the device.
  - Ensure a stress-free installation of the pipe connections between the device and the overall system.



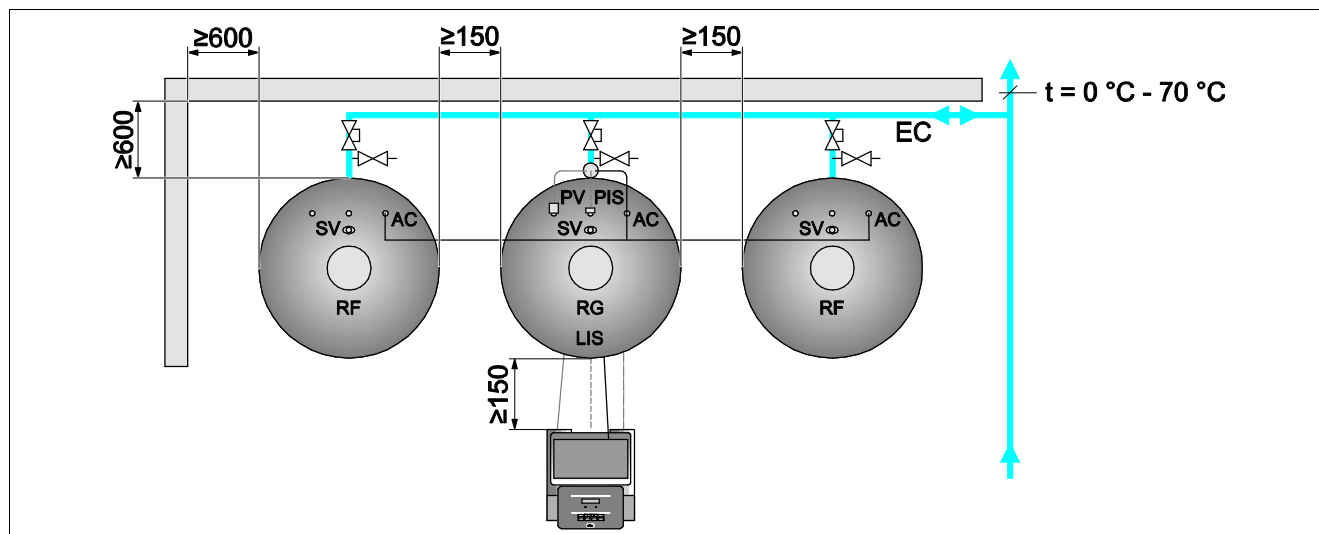
#### **Attention! – Equipment damage**

- Damages to the cables and pipes between the tanks and the control unit.
  - Properly install the cables and pipes over the flooring.



### 6.3.3.1 Water-side connection

The following describes the exemplary installation of the control unit before the primary tank and the connection of two secondary tanks. Proceed accordingly for other installation variants.



RF	Secondary tank
RG	Primary tank
SV	Safety valve
PV	Overflow solenoid valve

PIS	Pressure sensor
AC	Compressed air line
EC	Expansion line

To ensure the proper function of the "LIS" level sensor, you must use the supplied hose to flexibly connect the primary tank to the system.

The "EC" expansion line provides secure locking and emptying for primary tank and the optional secondary tanks. If more than one tank is used, a collective line to the system is installed.

Use points with temperatures between 0 °C and 70 °C to connect to the system. This is the return of the generator in heating systems and the flow in refrigeration systems.

At temperatures below or above 0 °C – 70 °C, you must install in-line vessels between the system and the Reflexomat.

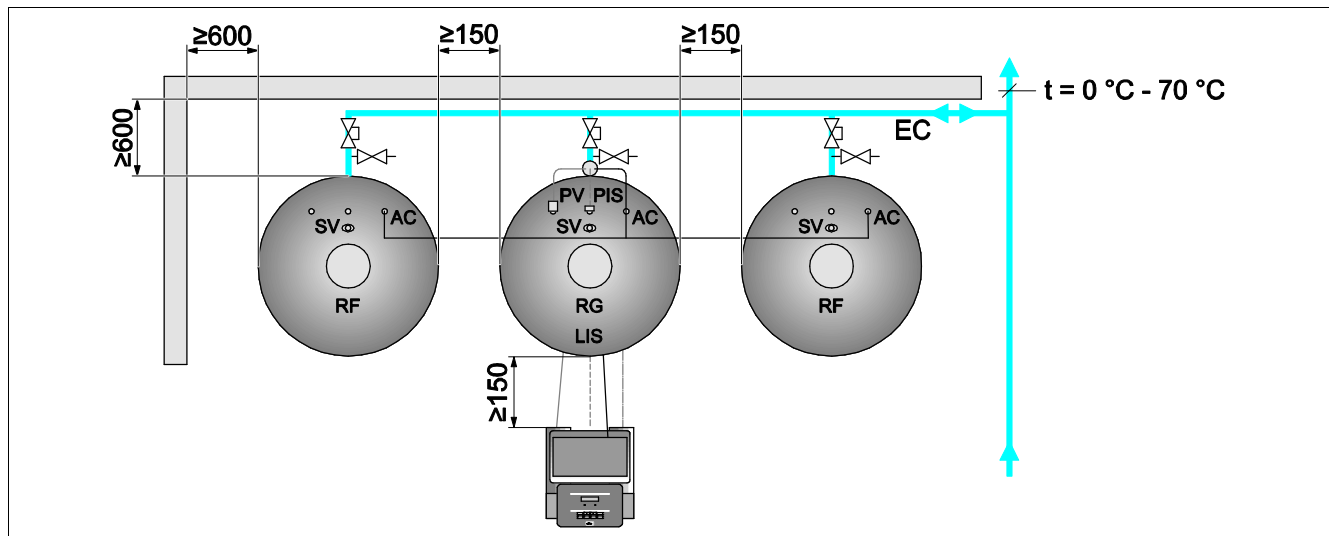


#### Notice!

For details regarding the switching of Reflexomats or in-line vessels and the dimensions of the expansion lines, please see the planning documents. More information is also provided in the Reflex Planning Guide.

### 6.3.3.2 Control unit connection

The following describes the exemplary installation of the control unit before the primary tank and the connection of two secondary tanks. Proceed accordingly for other installation variants.



RF	Secondary tank
RG	Primary tank
SV	Safety valve
PV	Overflow solenoid valve

PIS	Pressure sensor
AC	Compressed air line
EC	Expansion line

- The "PV" overflow solenoid valve, the "PIS" pressure transducer and the corresponding cables are factory-installed on the primary tank.
  - Run the cable through the assembly pipe on the rear of the primary tank to the control unit.
    - Cables are factory-installed in compact models.
- Subsequently install the level sensor at the primary tank, see chapter 6.3.4 "Fitting the level sensor" on page 27 .
  - Attach the cable to the "LIS" pressure pick-up of the level sensor and run the cable to the control unit.
    - For compact models, run the cable through the assembly pipe on the rear of the primary tank if it has not been factory-installed.
- The flexible compressed air hose is connected with the control unit. Run the compressed air hose through the assembly pipe as well.
  - If you install only the primary tank, you must connect the compressed air hose directly to the "AC" compressed air connection of the primary tank.
  - If you install secondary tanks, you install first the supplied distributor at the compressed air connection of the primary tank.
    - Use the supplied connection sets to connect the secondary tanks.

### 6.3.4 Fitting the level sensor



#### Attention! – Equipment damage

- Incorrect installation may result in damages to the "LIS" level sensor, malfunctioning and incorrect measurements from the pressure pick-up.
  - Comply with the instructions regarding the installation of the pressure pick-up.

The "LIS" level sensor uses a pressure pick-up. This pressure pick-up is to be installed after the primary tank has been placed at its final position, see chapter 6.3.2 "Tank installation" on page 23 . Comply with the following instructions:

- Remove the transport securing device (squared timber) at the vessel base of the primary tank.
- Replace this transport securing device with the pressure pick-up.
  - In the case of a tank volume of 1000 l (Ø 1000 mm) or more, use the supplied screws to attach the pressure pick-up at the vessel base of the primary tank.
- The vessel base must not be subject to stress after the pressure pick-up has been installed.
  - Avoid shock stresses by a subsequent alignment of the vessel, for example.
- Use flexible hoses to connect the primary tank and, if provided, the first secondary tank.
  - Use only the supplied connection sets.
- Perform a null balancing of the filling level when the primary tank is aligned and fully emptied, see chapter 7.7 "Parametrising the controller in the Customer menu" on page 42 .

#### Standard values for level measurements:

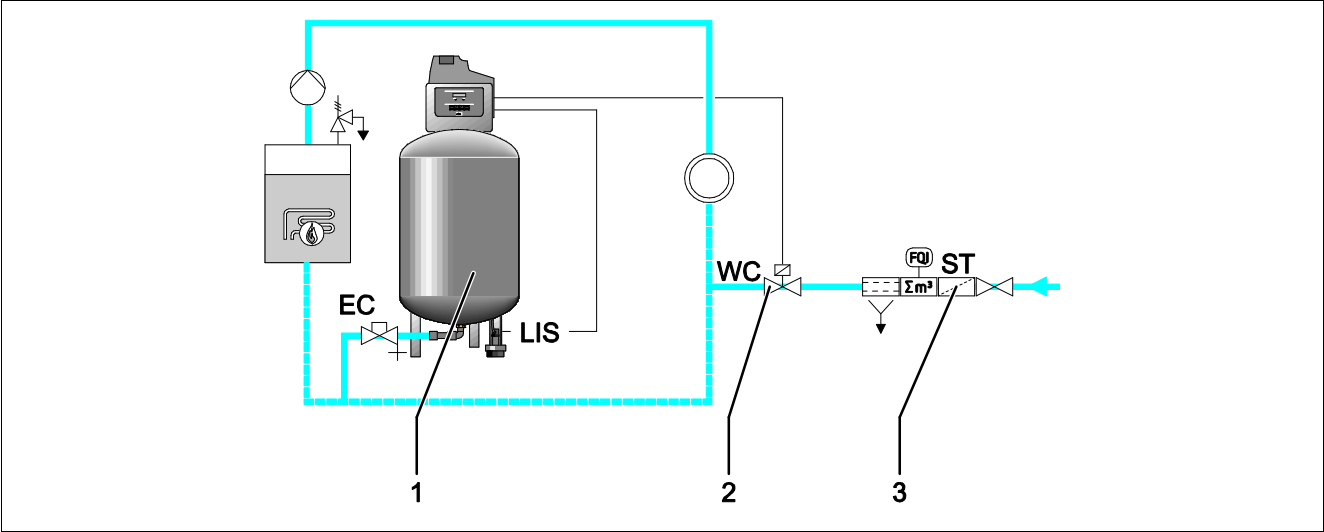
Primary tank	Measuring range
200 l	0 – 4 bar
300 – 500 l	0 – 10 bar
600 – 1000 l	0 – 25 bar
1500 – 2000 l	0 – 60 bar
3000 – 5000 l	0 – 100 bar

6.4 Make-up and degassing variants

The filling level is recorded in the "RG" primary tank by the "LIS" level sensor and evaluated in the controller. When the water level falls below the value specified in the controller's customer menu, the external make-up is activated.

Make-up without pump:

Reflexomat Compact RC with solenoid valve and ball valve.



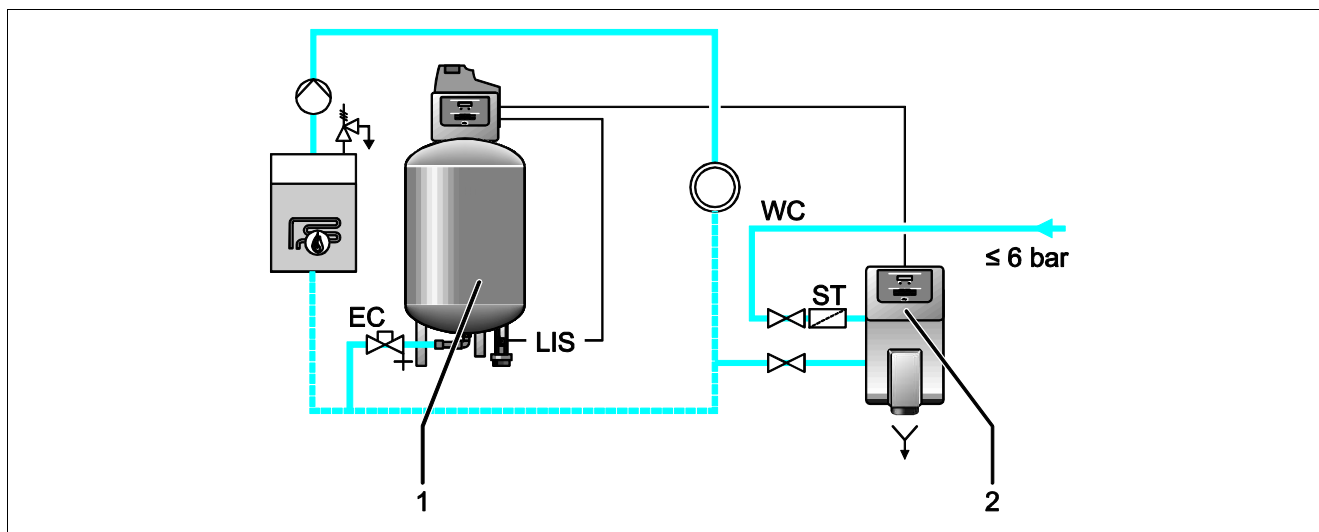
1	Reflexomat Compact RC
2	Solenoid valve with ball valve
3	Reflex Fillset
ST	Dirt trap

WC	Make-up line
LIS	Level sensor
EC	Expansion line

Preferably, you should use the Reflex Fillset with integrated system separator when using drinking water for make-up, see chapter 4.6 "Optional equipment and accessories" on page 14 . If you don't use a Reflex Fillset, you must use an "ST" dirt trap with a mesh size  $\geq 0.25$  mm for the make-up.

### Make-up with pump:

Reflexomat Compact RC with Reflex Fillcontrol Auto



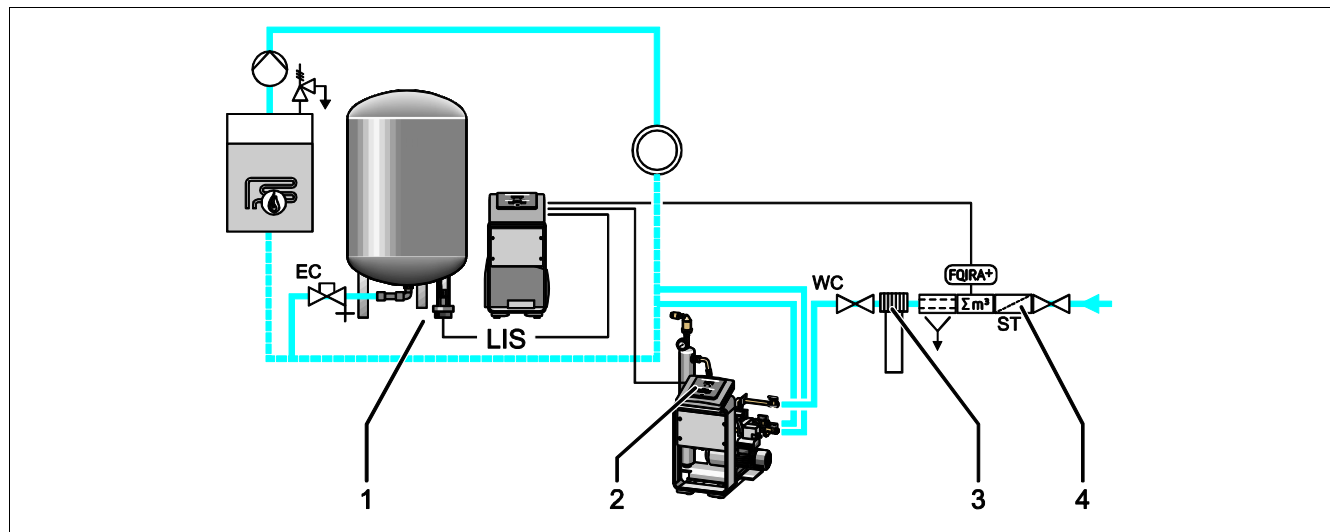
1	Reflexomat Compact RC
2	Fillcontrol Auto
WC	Make-up line

ST	Dirt trap
EC	Expansion line
LIS	Level sensor

Water make-up with Fillcontrol Auto is suitable for make-up at high system pressures of up to 8.5 bar, see chapter 4.6 "Optional equipment and accessories" on page 14 . The "ST" dirt trap is part of the deliverables.

**Make-up with softening and degassing**

Reflexomat RS 90/1 and Reflex Servitec.



1	Reflexomat RS 90/1 with stand-alone console
2	Reflex Servitec
3	Reflex Fillsoft
4	Reflex Fillset Impulse

ST	Dirt trap
WC	Make-up line
LIS	Level sensor
EC	Expansion line

The Reflex Servitec degassing and make-up station degasses the water from the facility system and the make-up water. The automatic water make-up for the facility system is controlled by the pressure maintenance system. Reflex Fillsoft additionally softens the make-up water.

- Reflex Servitec degassing and make-up station, see chapter 4.6 "Optional equipment and accessories" on page 14 .
- Reflex Fillsoft softening systems and Reflex Fillset Impulse, see chapter 4.6 "Optional equipment and accessories" on page 14 .

**Notice!**

When using Reflex Fillsoft softening systems, always install the Reflex Fillset Impulse.

- The controller evaluates the make-up quantities and signals a required replacement of the softening cartridges.

## 6.5 Electrical connection



### Danger – Electric shock!

- Serious injury or death due to electric shock.
  - Any system in which the device is to be installed must be de-energised.
  - Ensure that the system is locked and cannot be switched on by other personnel.
  - Installation work for the electric connection of the device must be carried out by an authorised electrician in compliance with electrical engineering regulations.



### Danger – Electric shock!

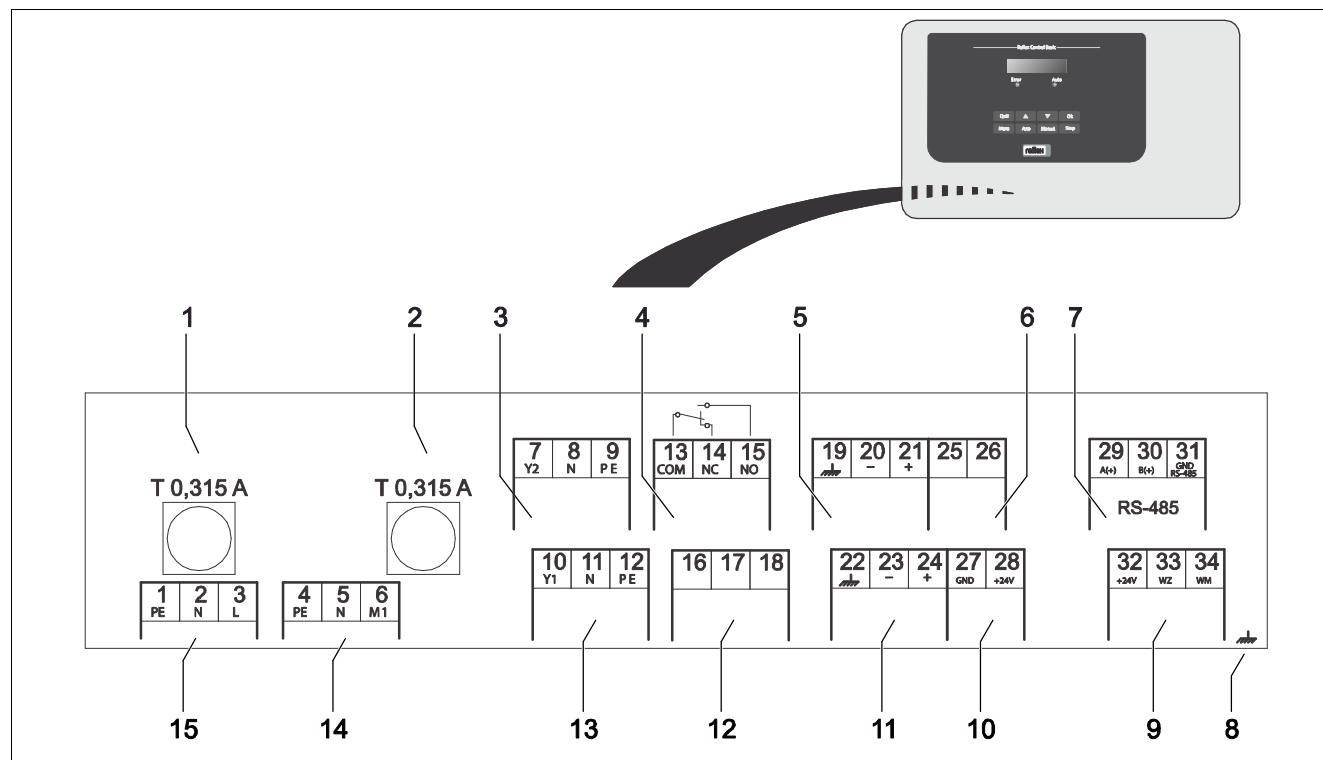
- Serious injury or death due to electric shock. Some parts of the main board may still carry 230V voltage even with the device physically isolated from the 230 V power supply.
  - Before you remove the covers, completely isolate the device controller from the power supply.

The following descriptions apply to standard systems and are limited to the necessary user-provided connections.

1. Shut down the system and secure it against unintentional reactivation.
2. Remove the cover.
3. Install a screwed cable gland suitable for the respective cable. M16 or M20, for example.
4. Thread all cables to be connected through the cable gland.
5. Connect all cables as shown in the terminal diagram, see chapter 6.5.1 "Terminal diagram" on page 32 .
  - Note that the fusing for the device connection is to be provided by the user, see chapter 5 "Technical data" on page 15 .

When all connections have been made according to the terminal diagram, install the cover and connect the the mains cable with the 230 V power supply.

## 6.5.1 Terminal diagram





Terminal number	Signal	Function	Wiring
1	PE	230 V power supply via mains cable and plug.	Factory
2	N		
3	L		
4	PE	Compressor for maintaining the pressure.	Factory
5N	N		
6 M1	M 1		
7	Y2	Overflow solenoid valve. • For controlling pressure maintenance in the overflow line.	Factory
8	N		
9	PE		
10	Y 1	230 V output for make-up. • To control a Reflex Fillcontrol, for example.	User, optional
11	N		
12	PE		
13	COM	Group message (floating).	User, optional
14	NC		
15	NO		
16	Not assigned	External make-up request. • Not used with the Reflexomat.	---
17	Make-up (230 V)		
18	Make-up (230 V)		
19	PE shield	Level analogue input. • Display at the controller. • Activation of the make-up.	Pre-wired, sensor plug must be attached on-site
20	- Level (signal)		
21	+ Level (+ 18 V)		
22	PE (shield)	Pressure analogue input. • Display at the controller. • Control of pressure maintenance.	Factory
23	- Pressure (signal)		
24	+ Pressure (+ 18 V)		
25	0 – 10 V (correcting variable)	Motor ball valve • Not used with the Reflexomat.	---
26	0 – 10 V (feedback)		
27	GND		
28	+ 24 V (supply)		
29	A	RS-485 interface.	User, optional
30	B		
31	GND		
32	+ 24 V (supply) E1	Supply for E1 and E2.	Factory
33	E1	Contact water meter (in Fillset, for example), see chapter 4.6 "Optional equipment and accessories" on page 14 . • Evaluation of the make-up. – If contact 32/33 is closed = meter pulse.	User, optional
34	E2	Insufficient water switch. • Not used with the Reflexomat. – If contact 32/34 is closed = OK.	---

## 6.5.2 RS-485 interface

Use this interface to retrieve all controller data and to enable the communication with control centres or other devices.

The following data can be requested:

- Pressure and level.
- Compressor operating states.
- Operating states of the ball valve in the overflow line.
- Operating states of make-up via solenoid valve.
- Cumulated quantity of the FQIRA + contact water meter.
- All messages, see chapter 8.2.4 "Messages" on page 50 .
- All entries in the fault memory.



### Notice!

If required, please contact the Reflex Customer Service for the protocol of the RS-485 interface, details of the connections and information about the accessories offered.

### 6.5.2.1 Connecting the RS-485 interface

- Use a shielded cable to connect the interface to terminals 29, 30, 31 of the main board in the control cabinet.
  - For connecting the interface, see chapter 6.5 "Electrical connection" on page 31 .
- When using the device with a control centre not supporting an RS-485 interface (RS-232, for example), you must use a corresponding adapter.



### Notice!

- For connecting the interface use only a cable with these properties.
  - LJYCY (TP),  $4 \times 2 \times 0.8$ , maximum overall bus length 1000 m.

## 6.6 Installation and commissioning certificate

Data shown on the nameplate:	$P_0$
Type:	$P_{SV}$
Serial number:	

This device has been installed and commissioned in accordance to the instructions provided in the Operating Manual. The settings in the controller match the local conditions.



### Notice!

When any factory-set values of the device are changed, you must enter this information in the Maintenance certificate, see chapter 9.4 "Maintenance certificate" on page 58 .

#### For the installation

Place, date	Company	Signature

#### For the commissioning

Place, date	Company	Signature

## 7 Commissioning



### Notice!

- The proper installation and commissioning must be confirmed in the installation, commissioning and maintenance certificate. This certificate is prerequisite for any warranty claim.
  - Have the Reflex Customer Service carry out commissioning and the annual maintenance.

### 7.1 Checking the requirements for commissioning

The device is ready for commissioning when the tasks described in Chapter Installation have been concluded. Comply with the following instructions for commissioning:

- The control unit is connected to the primary tank and the secondary tanks, if provided.
- The water connections of the tanks to the facility system are established.
- The tanks are not filled with water.
- The valves for emptying the tanks are open.
- The facility system is filled with water and gas-vented.
- The electrical connection has been created according to applicable national and local regulations.

## 7.2 Determining the $P_0$ minimum operating pressure for the controller

The " $P_0$ " minimum operating pressure is determined by the location of the pressure maintaining device. The controller calculates the switching points for the "PV" overflow valve and the "CO" controller from the " $P_0$ " minimum operating pressure.

Actuating pressure for the " $P_{sv}$ " safety valve

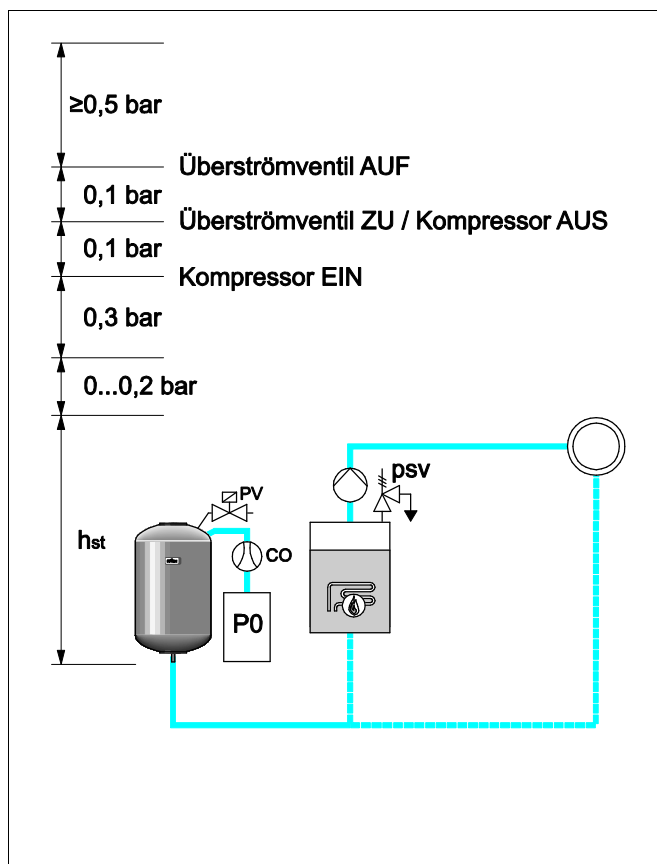
Overflow valve "OPEN" = final pressure " $P_e$ "

Overflow valve "CLOSED" / Compressor "OFF"

Compressor "ON" = initial pressure " $P_a$ "

Minimum operating pressure " $P_0$ "

Static pressure " $P_{st}$ "



The " $P_0$ " minimum operating pressure is calculated as follows:

$P_0 = P_{st} + P_D + 0.2 \text{ bar}^*$	Enter the calculated value in the start routine of the controller, see chapter 7.4 "Modifying the controller's start routine" on page 39 .
$P_{st} = h_{st}/10$	$h_{st}$ in metres
$P_D = 0.0 \text{ bar}$	for safety temperatures $\leq 100 \text{ }^\circ\text{C}$
$P_D = 0.5 \text{ bar}$	for safety temperatures $= 110 \text{ }^\circ\text{C}$

\*Addition of 0.2 bar recommended, no addition in extreme cases

Calculation example for " $P_0$ " minimum operating pressure:

Heating system: Static height 18 m, run-on temperature  $70 \text{ }^\circ\text{C}$ , safety temperature  $100 \text{ }^\circ\text{C}$ .

Calculation example:

$$P_0 = P_{st} + P_D + 0.2 \text{ bar}^*$$

$$P_{st} = h_{st}/10$$

$$P_{st} = 18 \text{ m}/10$$

$$P_{st} = 1.8 \text{ bar}$$

$$P_D = 0.0 \text{ bar at a safety temperature of } 100 \text{ }^\circ\text{C}$$

$$P_0 = 1.8 \text{ bar} + 0 \text{ bar} + 0.2 \text{ bar}$$

$$P_0 = 2.0 \text{ bar}$$

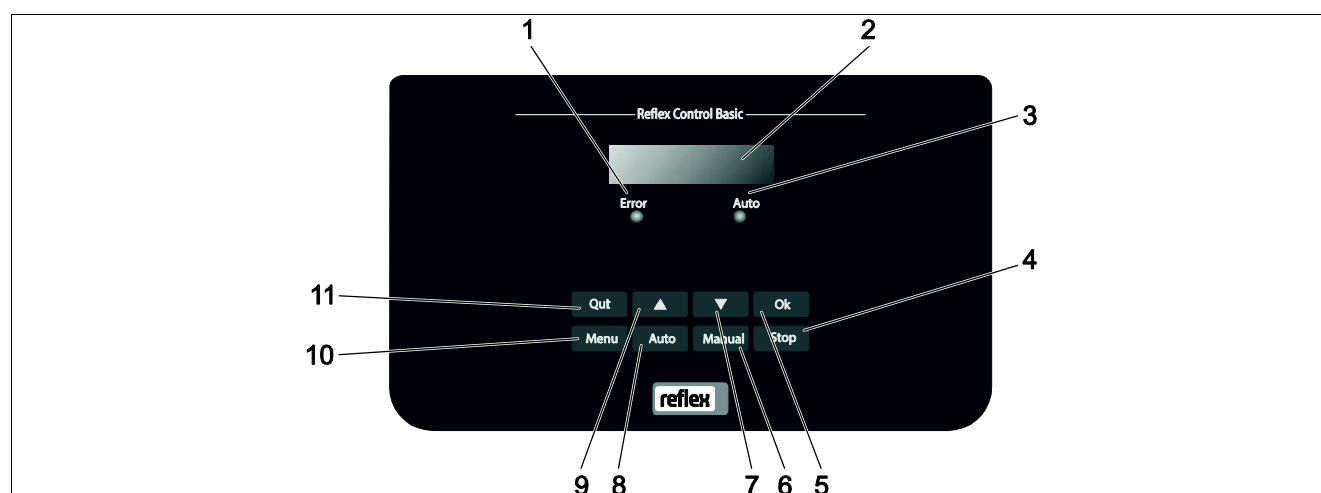


### Notice!

Avoid dropping below the " $P_0$ " minimum operating pressure. Vacuum, vaporisation and cavitation are thus excluded.

## 7.3 Controller

### 7.3.1 Operator panel



1	Error LED <ul style="list-style-type: none"> <li>The LED illuminates red during a fault alarm</li> </ul>
2	Display
3	Auto LED <ul style="list-style-type: none"> <li>The LED illuminates green during automatic operation</li> <li>The LED flashes green during manual operation</li> <li>The LED is not illuminated when the system is stopped</li> </ul>
4	Stop <ul style="list-style-type: none"> <li>For commissioning and entry of new values in the controller</li> </ul>
5	OK <ul style="list-style-type: none"> <li>Confirm actions</li> </ul>
6	Manual <ul style="list-style-type: none"> <li>For tests and maintenance tasks</li> </ul>

7	"Back" to the previous menu
8	Auto <ul style="list-style-type: none"> <li>For continuous operation</li> </ul>
9	"Forward" to the next menu
10	Menu <ul style="list-style-type: none"> <li>Call up the Customer menu</li> </ul>
11	Quit <ul style="list-style-type: none"> <li>Acknowledge messages</li> </ul>

#### Selecting and changing parameters

- Use "OK" (5) to select the parameter.
- Use the arrow buttons (7) or (9) to change the parameter value.
- Use "OK" (5) to confirm the parameter.
- Use the arrow buttons (7) or (9) to change the menu option.
- Use "Quit" (11) to switch to different menu level.

## 7.4 Modifying the controller's start routine

The start routine is used to set the required parameters for the device commissioning. It commences with the first activation of the controller and can be run only once. Parameters can be changed or checked in the customer menu after the start routine has terminated see chapter 8.2.1 "Customer menu" on page 48 .



### Notice!

Plug in the contact plug to provide power (230 V) to the controller.

You are now in Stop mode. The "Auto" LED on the operator panel has extinguished.

Device name

Reflexomat

Standard software with various languages.

Language

Prior to commissioning, read the entire operating manual and verify the proper assembly.

Read the operating manual!

Enter the value for the minimum operating pressure.

- Calculating the minimum operating pressure, see chapter 7.2 "Determining the  $P_0$  minimum operating pressure for the controller" on page 37 .

Min. op. pressure

Change the flashing display items for "Hour", "Minute", and "Seconds" to the current time.

- The time of an alarm will be stored in the fault memory.

Time

Change the flashing display items for "Day", "Month", and "Year" to the current date.

- The date of an alarm will be stored in the fault memory.

Date

Select the size of the primary tank.

- For the primary tank data, see the name plate or see chapter 5 "Technical data" on page 15 .

00500 l      740 mm  
GB = 0093 kg

Null balancing of the level sensor.

- The controller checks whether the level measuring signal matches the dimensional data of the primary tank. The primary tank must be fully emptied, see `dg_ref_source_inline>Montage Niveaumessung</dg_ref_source_inline>`.

1 %	1.7 bar
Null balancing!	

Upon successful conclusion of the null balancing, confirm with "OK" on the controller operator panel.

0 %	1.0 bar
Null balancing concluded successfully	

Select "Yes" or "No" on the controller display and confirm with "OK" on the controller operator panel.

Cancel null balancing?	No
------------------------	----

yes: The primary tank is fully emptied and the device is installed as per the instructions.

- If null balancing is still not possible, confirm with "Yes".. The start routine is terminated. Use the customer menu to repeat the null balancing, see chapter 6.3.4 "Fitting the level sensor" on page 27 .
- Subsequently contact your Reflex Customer Service, see chapter 8.2.1 "Customer menu" on page 48 .

no: The start routine restarts.

- Check the prerequisites for the commissioning, see chapter 11.1 "Reflex Customer Service" on page 61 .

This message appears on the display only after null balancing has been successful. Select "Yes" or "No" on the controller display and confirm with "OK" on the controller operator panel.

Terminate routine?	No
--------------------	----

yes: The start routine is terminated, the device automatically switches to Stop mode.

no: The start routine restarts.

The level indication is at 0 %.

0 %	2.0 bar
STOP	



### Notice!

After successful conclusion of the start routine, you are in Stop mode.

see chapter 7.1 "Checking the requirements for commissioning" on page 36



## 7.5 Tank venting



### Caution – risk of burning!

- Excessive surface temperatures at the compressor can cause skin to burn.
  - Wear suitable personal protective equipment (safety gloves, for example).

Upon completion of the start routine, you must vent the primary tank and the secondary tanks, if applicable.

- Open the tanks' discharge ports to permit the air to escape.
- Select Automatic mode on the controller's operator panel, see chapter 8.1.1 "Automatic mode" on page 47 .

The "CO" compressor builds up the pressure required venting. This pressure is 0.4 bar above the set minimum operating pressure. The tanks' diaphragms are pressurised to this level and the water side in the tanks is vented. Close the discharge ports of all tanks after the compressor has automatically shut down.



### Notice!

Inspect all compressed air connections between the control unit and the tanks for leaks. Subsequently, slowly open all cap valves at the tanks to create the water-side connection to the facility system.

## 7.6 Filling the tanks with water

Prerequisite for fault-free filling is a make-up pressure at least 1.3 bar above the set minimum pressure "P<sub>0</sub>".

- Without automatic make-up:
  - Use the discharge ports or the facility system to manually fill the individual tank to approximately 30 % of the tank volume, see chapter 6.4 "Make-up and degassing variants" on page 28 .
- With automatic make-up:
  - The tanks are automatically filled to approximately 12 % of the tank volume, see chapter 6.4 "Make-up and degassing variants" on page 28 .

## 7.7 Parametrising the controller in the Customer menu

Use the Customer menu to display or correct system-specific values. In the course of commissioning, the factory settings must be adjusted for the system-specific conditions.



### Notice!

Operation description, see chapter 7.3.1 "Operator panel" on page 38 .

All grey marked menu items must be reviewed during commissioning.

Press "Manual" to switch to manual operation.

Press "Menu" to display the first main menu option "Customer menu".

Switch to the next main menu option.

Customer menu

Standard software with various languages.

Language

Adjust the "Hour", "Minute", and "Second" display when each begins to flash.  
This time is used for entries in the fault memory.

Time:

Adjust the "Day", "Month", and "Year" display when each begins to flash.  
This date is used for entries in the fault memory.

Date:

The controller checks whether the level sensor signal matches the value entered for the "RG" primary tank in the controller, see chapter 7.4 "Modifying the controller's start routine" on page 39 .

1 % 1.7 bar  
Null balancing?



### Notice!

The "RG" primary tank must be completely empty.

One of the following messages appears on the display:

- Null balancing concluded successfully.
  - Confirm with the "▼" button.
- Empty the tank and repeat the process.
  - Confirm with "OK".

0 % 0 bar  
Null balancing concluded  
successfully!

This message appears when null balancing has failed. Select "Yes" or "No" on the display.

**Yes:** The "RG" primary tank is empty and the device is installed as per the instructions. If null balancing is still not possible, cancel with "Yes". Contact your Reflex Customer Service.

**No:** Check the prerequisites for the commissioning, see chapter 7.1 "Checking the requirements for commissioning" on page 36 .  
The controller's start routine is restarted.

Confirm the selection of "Yes" or "No" with "OK".

0 % 0 bar  
Cancel null balancing No

Enter the value for the minimum operating pressure.



**Notice!**

Calculation of minimum operating pressure, see chapter 7.2 "Determining the  $P_0$  minimum operating pressure for the controller" on page 37 .

Min.op.pressure

01.8 bar

Switch to the "Make-up" main menu.

- Press "OK" to open the menu.
- Use the "▼▲" buttons to open the sub-menu.

Make-up

If the water content is below the specified tank size, add water, see chapter 7.4 "Modifying the controller's start routine" on page 39 .

- If an automatic make-up device (Fillcontrol for example) is installed, make-up will be actuated automatically; otherwise the make-up must be manually activated.

Make-up: ON

at: 08 %

Terminate the water make-up when the specified tank size is exceeded.

- If an automatic make-up device is installed, make-up will be shut off automatically; otherwise the make-up must be manually deactivated.
- If you have selected "No" for automatic make-up, the system will not return any further queries about the make-up.

Make-up: OFF

at: 12 %

Pre-selected time for a make-up cycle. Upon expiry of this set time, the system interrupts the make-up and returns the "Make-up time" fault message.

Max. make-up time

010 min.

If the set number of make-up cycles is exceeded within two hours, the system interrupts the make-up and returns the "Make-up cycles" fault message.

Max. make-up cycl.

003 / 2 h

yes: FQIRA+ contact water meter is installed, see chapter 9.3.2 "Cleaning the dirt trap" on page 57 .  
This is the prerequisite for the make-up quantity monitoring and the operation of a softening system.

no: A contact water meter is not installed (standard model).

With water meter

YES

Only displayed if "YES" has been set in the "With water meter" menu option.

- Use "OK" to delete the counter.
  - Press "YES" to reset the value displayed to "0".
  - Press "No" to retain the displayed value.

Make-up quantity

000020 l

This value is only displayed if "YES" has been set in the "With water meter" menu option.

- When the set quantity is exceeded, the system interrupts the make-up process and returns the error message "Max. make-up quantity exceeded".

Max. make-up qty.

000100 l

This value is only displayed if "YES" has been set in the "With water meter" menu option.

With softening

YES

yes: The system offers more queries regarding the softening process.

no: The system does not offer more queries regarding the softening process.

This value is only displayed if "YES" has been set in the "With softening" menu option.

Lock make-up?

YES

yes: The system stops the make-up process when the set soft water capacity is exceeded.

no: The system does not stop the make-up process. The system displays the "Softening" message.

This value is only displayed if "YES" has been set in the "With softening" menu option.

- Hardness reduction is calculated from the difference of the overall water hardness of the raw water  $GH_{\text{actual}}$  and the target water hardness  $GH_{\text{target}}$ .

$$\text{Hardness reduction} = GH_{\text{actual}} - GH_{\text{target}} \text{ °dH}$$

Hardness reduction

10 °dH

Enter the value in the controller. Consult the manufacturer information for third-party products.

This value is only displayed if "YES" has been set in the "With softening" menu option.

The attainable soft water capacity is calculated from the type of softening used and the specified hardness reduction.

- Fillsoft I, soft water capacity  $\leq 6000/\text{hardness red. l}$
- Fillsoft II, soft water capacity  $\leq 12000/\text{hardness red. l}$

Enter the value in the controller. Consult the manufacturer information for the values of third-party products.

Cap. soft water

05000 l

This value is only displayed if "YES" has been set in the "With softening" menu option. It indicates the still remaining soft water capacity. The soft water capacity cannot be set and is calculated from the hardness reduction and the soft water capacity.

Remaining cap. soft w.

000020 l

This value is only displayed if "YES" has been set in the "With softening" menu option.

- Manufacturer specification for the replacement interval of the softening cartridges, regardless of the calculated soft water capacity. The system displays the "Softening" message.

Recommended maintenance messages.

Off: Without maintenance recommendation.

001 – 060: Maintenance recommendation in months.

For the output of messages to the floating contact, see chapter 4.6 "Optional equipment and accessories" on page 14 .

yes: Output of all messages.

no: Output of all messages identified with "xxx" ("05", for example).

Switch to the "Fault memory" main menu.

- Press "OK" to open the menu.
- Use the "▼▲" buttons to open the sub-menu.

The last 20 alarms are stored with fault type, date, time, and fault code.

See the chapter "Messages" for more information about the ER... messages.

Switch to the "Parameter memory" main menu.

- Press "OK" to open the menu.
- Use the "▼▲" buttons to open the sub-menu.

The last 10 entries of the minimum working pressure are stored with date and time.

The system displays the values for the volume and the diameter of the "RG" primary tank.

- If you identify differences to the information provided on the primary tank's nameplate, please contact the Reflex Customer Service.

Information about the software version

Replacement

18 months

Next maintenance

012 months

Floating fault contact

YES

Fault memory>

ER 01...xx

05

Fault type | Date | Time

Parameter memory>

P0 = xx.x bar

Date | Time

Tank info

00800 l

Reflexomat

V1.00

## 7.8 Starting Automatic mode

Automatic operation can be set after initial commissioning. Start the automatic mode at the operator panel of the controller.

The following prerequisites must be met for automatic operation:

- The device is filled with compressed air and water.
- All required parameters are defined in the controller.

Press "Auto" for automatic mode at the controller operator panel.

- The "Auto" LED at the operator panel illuminates to visually signal automatic mode.



### **Notice!**

Initial commissioning is completed and the device is in continuous operation.

## 8 Operation

### 8.1 Operating modes

#### 8.1.1 Automatic mode

After successful commissioning, start the Automatic mode from the device. The Automatic mode is suitable for continuous device operation and the controller monitors the following functions:

- Maintain pressure
- Compensate expansion volume
- Automatic make-up

To start automatic operation, press "Auto" at the controller operator panel. The "CO" compressor and the "PV1" solenoid valve are regulated by the controller so that the pressure remains constant at a regulation range of  $\pm 0.1$  bar. Faults are displayed and evaluated.

#### 8.1.2 Manual mode

The manual mode is intended for test and service tasks.

Press "Manual" on the controller. The "Auto" LED at the operator panel flashes to visually indicate that Manual mode is active. Manual mode enables you to select the following functions and to perform a test run:

- "CO" compressor.
- "PV1" overflow solenoid valve.
- The solenoid valve of the "WV1" make-up.

You can switch several functions after each other and test them at the same time.

- Use the "Switch up/down" keys to select the function.
  - "CO1" = Compressor
  - "PV1" = Solenoid valve in the overflow line
  - "WV1" = Make-up solenoid valve
- Press "OK".
  - Confirm the selection or shut-down of the individual functions.
- "Quit" button
  - Shut-down of the individual functions in reverse order.
  - Press "Quit" for the last time and the system moves in Stop mode.
- "Auto" button
  - Return to Automatic mode.

30%		2.5 bar
CO1!*	PV1	WV1

\* Units with "!" are selected and active.



#### Notice!

Manual operation can not be performed if safety-relevant parameters are exceeded.

- Switching is blocked if safety-relevant parameters are exceeded.

### 8.1.3 Stop mode

The Stop mode is intended for the device commissioning.

Press "Stop" on the controller. The "Auto" LED at the operator panel extinguishes.

Except for the display of information, the device is non-functional in Stop mode. Function monitoring is stopped.

The following functions are deactivated:

- The "CO" compressor (shut off in Stop mode).
- The solenoid valve in the "PV" overflow line (closed in Stop mode).
- The solenoid valve in the "WV" make-up line (closed in Stop mode).



#### **Notice!**

The system returns an alarm if the Stop mode is activated for more than 4 hours.

- If "Floating alarm contact?" in the Customer menu is set to "Yes", the system outputs the alarm to the group alarm contact.

## 8.2 Controller

### 8.2.1 Customer menu

Use the Customer menu to set the device controller during commissioning. You can then correct or retrieve system-specific values during operation, see chapter 7.7 "Parametrising the controller in the Customer menu" on page 42 .

### 8.2.2 Service menu

This menu is protected with a password. It can be accessed only by the Reflex Customer Service. A partial summary of the settings stored in the Service menu is provided in the Chapter Default settings.

see chapter 8.2.3 "Default settings" on page 49



### 8.2.3 Default settings

The device controller is shipped with the following default settings. Use the Customer menu to adjust these values to local conditions. In specific cases, it is possible to further adjust the values in the Service menu.

#### Customer menu

Parameter	Setting	Remarks
Language	EN	Display language.
Minimum operating pressure "P <sub>0</sub> "	1.8 bar	see chapter 7.2 "Determining the P <sub>0</sub> minimum operating pressure for the controller" on page 37 .
Next maintenance	12 months	Time left to the next due maintenance.
Floating alarm contact	YES	see chapter 8.2.4 "Messages" on page 50 .
<b>Make-up</b>		
Make-up "ON"	8 %	
Make-up "OFF"	12 %	
Maximum make-up quantity	0 Litres	Only when "With water meter Yes" has been selected in the Customer menu under Make-up.
Maximum make-up time	30 minutes	
Maximum make-up cycles	6 cycles within 2 hours	
<b>Softening (Only if "With softening Yes")</b>		
Lock make-up	No	In the case of soft water residual capacity = 0
Hardness reduction	8°dH	= Target – Actual
Maximum make-up quantity	0 Litres	
Soft water capacity	0 Litres	
Cartridge replacement	18 months	Replace cartridge.

#### Service menu

Parameter	Setting	Remarks
<b>Maintain pressure</b>		
Compressor "ON"	P <sub>0</sub> + 0.3 bar	Differential pressured added to the "P <sub>0</sub> " minimum operating pressure.
Compressor "OFF"	P <sub>0</sub> + 0.4 bar	Differential pressured added to the "P <sub>0</sub> " minimum operating pressure.
"Compressor run time exceeded" message	240 minutes	The message is displayed after the compressor runs for 240 minutes.
Overflow line "CLOSED"	P <sub>0</sub> + 0.4 bar	Differential pressured added to the "P <sub>0</sub> " minimum operating pressure.
Overflow line "OPEN"	P <sub>0</sub> + 0.5 bar	Differential pressured added to the "P <sub>0</sub> " minimum operating pressure.
Maximum pressure	P <sub>0</sub> + 3 bar	Differential pressured added to the "P <sub>0</sub> " minimum operating pressure.
<b>Filling levels</b>		
Insufficient water "ON"	5 %	
Insufficient water "OFF"	12 %	
Solenoid valve in overflow line "CLOSED"	90 %	

## 8.2.4 Messages

The display provides alarms in plain text and the ER codes shown in the list. Use the arrow buttons to scroll through multiple alarms displayed at the same time, see chapter 7.3.1 "Operator panel" on page 38.

The fault memory stores the last 20 alarms for review, see chapter 7.7 "Parametrising the controller in the Customer menu" on page 42. Alarm causes can be eliminated by the operator or a specialist workshop. If this is not possible, contact the Reflex Customer Service.



### Notice!

When the cause for the alarm is eliminated, you must acknowledge the fault with "Quit" at the controller's operator panel. All other alarms are automatically reset as soon as the cause has been eliminated.



### Notice!

Floating contacts, setting in the Customer menu, see chapter 7.7 "Parametrising the controller in the Customer menu" on page 42.

ER Code	Alarm	Floating contact	Causes	Remedy	Alarm reset
01	Minimum pressure	YES	<ul style="list-style-type: none"> <li>Set value not reached.</li> <li>Water loss in the system.</li> <li>Compressor fault.</li> <li>Controller in Manual mode.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check water level.</li> <li>Check compressor.</li> <li>Set the controller to Automatic mode.</li> </ul>	"Quit"
02.1	Insufficient water	-	<ul style="list-style-type: none"> <li>Set value not reached.</li> <li>Make-up disabled.</li> <li>Air in the system.</li> <li>Dirt trap clogged.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Clean the dirt trap.</li> <li>Check functioning of the "PV1" solenoid valve.</li> <li>If necessary, manually add water.</li> </ul>	-
03	High water	YES	<ul style="list-style-type: none"> <li>Set value exceeded.</li> <li>Make-up disabled.</li> <li>Water intake through a leak in a thermal transfer medium of the user.</li> <li>"RG" and "RG" tanks too small.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check functioning of the "WV1" solenoid valve.</li> <li>Drain water from the "VG" tank.</li> <li>Check user's thermal transfer medium for leaks.</li> </ul>	-
04.1	Compressor	YES	<ul style="list-style-type: none"> <li>Compressor disabled.</li> <li>Fuse defective.</li> </ul>	<ul style="list-style-type: none"> <li>Check set values in the Customer or Service menu.</li> <li>Replace the fuse.</li> </ul>	"Quit"

ER Code	Alarm	Floating contact	Causes	Remedy	Alarm reset
05	Compressor run time	-	<ul style="list-style-type: none"> <li>Set value exceeded.</li> <li>Severe water loss in the system.</li> <li>Air lines leaking.</li> <li>Solenoid valve in the overflow line does not close.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check the water loss and correct, if necessary.</li> <li>Seal any leak in the air system.</li> <li>Check functioning of the "PV1" solenoid valve.</li> </ul>	-
06	Make-up time	-	<ul style="list-style-type: none"> <li>Set value exceeded.</li> <li>Water loss in the system.</li> <li>Make-up line not connected.</li> <li>Make-up rate insufficient.</li> <li>Make-up hysteresis too low.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check water level.</li> <li>Connect make-up line</li> </ul>	"Quit"
07	Make-up cycles	-	Set value exceeded.	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Seal any leak in the system.</li> </ul>	"Quit"
08	Pressure measurement	YES	Controller receives incorrect signal.	<ul style="list-style-type: none"> <li>Connect the plug.</li> <li>Check functioning of the pressure sensor.</li> <li>Check the cable for damage.</li> <li>Check the pressure transducer.</li> </ul>	"Quit"
09	Level sensor	YES	Controller receives incorrect signal.	<ul style="list-style-type: none"> <li>Check functioning of the oil pick-up sensor.</li> <li>Check the cable for damage.</li> <li>Connect the plug.</li> </ul>	"Quit"
10	Maximum pressure	-	<ul style="list-style-type: none"> <li>Set value exceeded.</li> <li>Overflow line disabled.</li> <li>Dirt trap clogged.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check functioning of the overflow line.</li> <li>Clean the dirt trap.</li> </ul>	"Quit"
11	Make-up quantity	-	<p>"With water meter" must be activated in the Customer menu.</p> <ul style="list-style-type: none"> <li>Set value exceeded.</li> <li>Severe water loss in the system.</li> </ul>	<ul style="list-style-type: none"> <li>Check set value in the Customer or Service menu.</li> <li>Check water loss in the system and repair, if necessary.</li> </ul>	"Quit"

ER Code	Alarm	Floating contact	Causes	Remedy	Alarm reset
15	Make-up valve	-	Contact water meter measures without make-up request.	Check the make-up valve for leaks.	"Quit"
16	Power failure	-	No power.	Connect to power.	-
19	Stop > 4 hours	-	Device is in Stop mode for more than 4 hours.	Set the controller to Automatic mode.	-
20	Max. Make-up volume	-	Set value exceeded.	Reset the "Make-up quantity" meter in the Customer menu.	"Quit"
21	Maintenance recommended	-	Set value exceeded.	Perform maintenance and reset the maintenance counter upon completion.	"Quit"
24	Softening	-	<ul style="list-style-type: none"> <li>Set value for soft water capacity exceeded.</li> <li>Time interval for replacement of the softening cartridge exceeded.</li> </ul>	Replace the softening cartridges.	"Quit"
30	I/O module fault	-	<ul style="list-style-type: none"> <li>I/O module defective.</li> <li>Connection between option card and controller faulty.</li> <li>Option card defective.</li> </ul>	Contact the Reflex Customer Service.	-
31	EEPROM defective	YES	<ul style="list-style-type: none"> <li>EEPROM defective.</li> <li>Internal calculation error.</li> </ul>	Contact the Reflex Customer Service.	"Quit"
32	Undervoltage	YES	Supply voltage not achieved.	Check power supply.	-
33	Adjustment parameter faulty	-	EPROM parameter memory defective.	Contact the Reflex Customer Service.	-
34	Main board communication faulty	-	<ul style="list-style-type: none"> <li>Connecting cable defective.</li> <li>Main board defective.</li> </ul>	Contact the Reflex Customer Service.	-
35	Digital input voltage faulty	-	Short-circuit of input voltage.	Check the wiring at the digital inputs (water meter, for example).	-
36	Analogue input voltage faulty	-	Short-circuit of input voltage.	Check the wiring at the analogue inputs (pressure/level).	-

## 9 Maintenance



### Caution – risk of burning!

- Risk of burning from escaping medium
  - Maintain sufficient distance from the escaping medium.
  - Wear suitable personal protective equipment (safety gloves and goggles, for example).



### Danger – Electric shock!

- Serious injury or death due to electric shock.
  - Any system in which the device is to be installed must be de-energised.
  - Ensure that the system is locked and cannot be switched on by other personnel.
  - Installation work for the electric connection of the device must be carried out by an authorised electrician in compliance with electrical engineering regulations.

The device is to be maintained annually.

- The maintenance intervals depend on the operating conditions and the degassing times.

The annual maintenance is displayed upon expiry of the set operating time. Use "Quit" to acknowledge the "Maintenance recommended" message. Reset the maintenance counter in the Customer menu.



### Notice!

Maintenance work must be carried out and confirmed by specialist personnel or the Reflex Customer Service, see chapter 9.4 "Maintenance certificate " on page 58 .

### 9.1 Maintenance schedule

The maintenance schedule is a summary of maintenance tasks to be carried out regularly.

Maintenance task	Conditions			Interval
▲= Check, ■= Service, ● = Clean				
Check for leaks. <ul style="list-style-type: none"> <li>• "CO" compressor.</li> <li>• Screw connections of the compressed air connections.</li> </ul>	▲	■		Annually
Check switching points. <ul style="list-style-type: none"> <li>• "CO" compressor cut-in pressure.</li> <li>• Insufficient water.</li> <li>• Make-up with water.</li> </ul>	▲			Annually
Clean "ST" dirt trap. <ul style="list-style-type: none"> <li>– see chapter 9.3.2 "Cleaning the dirt trap" on page 57 .</li> </ul>	▲	■	●	Depending on the operating conditions
Remove condensate from the primary tank and the secondary tanks, if applicable. <ul style="list-style-type: none"> <li>– see chapter 9.3.1 "Cleaning the tanks" on page 56 .</li> </ul>	▲	■	●	Annually

## 9.2 Checking switching points

Prerequisite for checking the switching points are the following correct settings:

- Minimum operating pressure  $P_0$ , see chapter 7.2 "Determining the  $P_0$  minimum operating pressure for the controller" on page 37 .
- Level sensor at the primary tank.

Preparation

1. Switch to Automatic mode.
2. Close the cap valves upstream of the tanks.
3. Record the displayed filling level (value in %).
4. Drain the water from the tanks.

Checking the cut-in pressure

5. Check the cut-in and cut-out pressure of the "CO" compressor.
  - The compressor cuts in at  $P_0 + 0.3$  bar.
  - The compressor cuts out at  $P_0 + 0.4$  bar.

Checking the Make-up "On"

6. If necessary, check the make-up value displayed at the controller.
  - The automatic make-up is activated at a level display of 8 %.

Checking Insufficient water "On"

7. Switch off the make-up and continue to drain water from the tanks.
8. Check the displayed value for the "Insufficient water" filling level message.
  - Insufficient water "On" is displayed at the controller at a minimum filling level of 5 %.
9. Switch to Stop mode.
10. Switch off the main switch.

Cleaning the tanks

If necessary, remove condensate from the tanks, see chapter 9.3.1 "Cleaning the tanks" on page 56 .

#### Activating the device

11. Switch on the main switch.
12. Switch to Automatic mode.
  - Depending on the filling level and pressure, the "CO" compressor and the automatic make-up will be switched on.
13. Slowly open the cap valves upstream of the tanks and secure them against unintended closing.

#### Checking Insufficient water "Off"

14. Check the displayed value for the Insufficient water "OFF" filling level message.
  - Insufficient water "Off" is displayed at the controller at a minimum filling level of 8 %.

#### Checking Make-up "Off"

15. If necessary, check the make-up value displayed at the controller.
  - The automatic make-up is deactivated at a level display of 12 %.

Maintenance is completed.

**Notice!**

If automatic make-up is not connected, you must manually fill the tanks with water to the recorded filling level.

**Notice!**

The setting values for pressure maintenance, filling levels and make-up are provided in the chapter Standard settings, see chapter 8.2.3 "Default settings" on page 49 .

## 9.3 Cleaning

### 9.3.1 Cleaning the tanks



#### Caution – risk of injury!

- Maintenance work can cause injuries if the connections have been installed incorrectly because condensate under pressure can suddenly escape.
  - Ensure proper connections for the draining of condensate.
  - Wear suitable personal protective equipment (safety gloves and safety goggles, for example).

Regularly clean the tanks from condensate. The cleaning intervals depend on the local operational conditions.

#### Reflexomat RC – Tanks with permanently installed diaphragm

1. Record the level value displayed at the controller.
2. Press "Manual" at the operator panel to switch the controller into Manual mode.
3. Remove the silencer from the "PV" overflow solenoid valve.
4. Install a suitable hose in the "PV" overflow solenoid valve to drain condensate.
5. Slowly open the "PV" overflow solenoid valve.
  - Manually add water if the pressure in the system drops heavily, see chapter 6.4 "Make-up and degassing variants" on page 28.
  - If the "PV" overflow solenoid valve discharges more than 5 litres of water or condensate, you must check the diaphragm for rupture.
    - The tank must be replaced if the diaphragm has ruptured.
6. Close the "PV" overflow solenoid valve when the display indicates a 100% level.
7. Start the "CO" compressor to build up pressure.
  - If you had to add water during draining the condensate, you must monitor the pressure build up. At excessive pressure rise, drain water from the system accordingly.
8. Switch the controller into Automatic mode when the recorded level is displayed at the controller.
9. Remove the hose from the "PV" overflow solenoid valve and re-install the silencer.
10. Maintenance is completed.

#### Reflexomat RS – Tanks with replaceable diaphragm

1. Close the cap valves upstream of the tanks.
2. Record the level value at the controller display and drain the water from the tanks.
3. Switch off the main switch and pull the mains plug.
4. Open the discharge ports at the tanks to drain the condensate.
  - If more than 5 litres of water or condensate are discharged, you must check the tanks.
    - Check the diaphragms for rupture.
    - Check the tank interior walls for corrosion damage.
5. Close the tanks' discharge ports.
6. Insert the mains plug into the power supply and switch on the main switch.
7. Open the cap valves upstream of the tanks and secure them against unintended "closing".
8. Fill water and compressed air into the tanks until the recorded level value is displayed.
9. Maintenance is completed.



#### Notice!

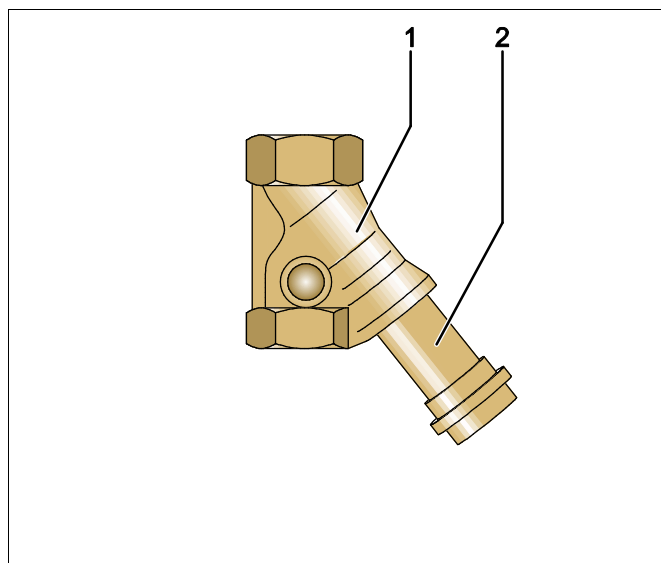
Check the installation location of the tanks for sufficient ventilation if the tank interior wall are damaged by corrosion, see chapter 6.2 "Preparatory work" on page 20.



### 9.3.2 Cleaning the dirt trap

Regularly clean the "ST" dirt trap. The cleaning intervals depend on the local operational conditions.

- Switch to Stop mode.
  - Press "Stop" on the controller's operator panel.
- Close the ball valves upstream and downstream of the "ST" (1) dirt trap.
- Slowly unscrew the dirt trap insert (2) from the dirt trap in order for the residual pressure to escape from the pipeline segment.
- Pull the mesh from the dirt trap insert and rinse it with clear water. Use a soft brush for cleaning.
- Re-insert the mesh into the dirt trap insert, check the gasket for damage, and screw the dirt trap insert back into the housing of the "ST" (1) dirt trap.
- Re-open the ball valves upstream and downstream of the "ST" (1) dirt trap.
- Switch to Automatic mode.
  - Press "Auto" on the controller's operator panel.



1	"ST" dirt trap	2	Dirt trap insert
---	----------------	---	------------------



#### Notice!

Clean all other installed dirt traps (in the Reflex Fillset, for example).

[illegible]

## **9.5 Inspection**

### **9.5.1 Pressure-bearing components**

Comply with all applicable national regulations for the operation of pressure equipment. De-pressurise all pressurised components prior to inspection (see disassembly information).

### **9.5.2 Inspection prior to commissioning**

In Germany, follow the Industrial Safety Regulation [Betriebssicherheitsverordnung] Section 14 and Section 14 (3) No. 6 in particular.

### **9.5.3 Inspection intervals**

Recommended maximum inspection intervals for operation in Germany pursuant to Section 15 of the Industrial Safety Regulation [Betriebssicherheitsverordnung] and the vessel classification of the device in diagram 2 of the EU Directive 97/23/EC, applicable in strict compliance with the Reflex Installation, Operation and Maintenance Manual.

#### **External inspection:**

No requirement according to Section 15 (6).

#### **Internal inspection:**

Maximum interval according to Section § 15 (5); if necessary, suitable replacement actions are to be taken (such as wall thickness measurement and comparison with the design specification which may be requested from the manufacturer)..

#### **Tightness test:**

Maximum interval according to Section 15 (5), possibly in conjunction with Section 15 (10).

Furthermore, compliance with Section 15 of the Industrial Safety Regulation and Section 15 (1) in particular, in conjunction with Section 14 (3) No. 6 and Section 15 (6), must be ensured.

The actual intervals must be determined by the user on the basis of a safety-technical assessment taking into account the real operational conditions, the experience with the operation and the charging material, and the national regulations for the operation of pressure equipment.

## 10 Disassembly



### Danger – Electric shock!

- Serious injury or death due to electric shock.
  - Any system in which the device is to be installed must be de-energised.
  - Ensure that the system is locked and cannot be switched on by other personnel.
  - Installation work for the electric connection of the device must be carried out by an authorised electrician in compliance with electrical engineering regulations.



### Danger – Electric shock!

- Serious injury or death due to electric shock. Some parts of the main board may still carry 230V voltage even with the device physically isolated from the 230 V power supply.
  - Before you remove the covers, completely isolate the device controller from the power supply.



### Caution – risk of burning!

- Excessive surface temperatures in heating systems can cause skin to burn.
  - Wait until surfaces have cooled down or wear protective gloves.
  - The operator is required to attach corresponding warning notes in the device vicinity.



### Caution – risk of injury!

- Incorrect installation or service work may cause burns and other injuries at the connections when hot water or steam suddenly escape at pressure.
  - Ensure proper disassembly.
  - Ensure that the system is de-pressurised before performing the disassembly.

- Prior to disassembly, disconnect all water-sided connections from the device.
  - Vent the device to de-pressurise it.
1. Disconnect the system from the power supply and secure it against unintended reactivation.
  2. Disconnect the power cable of the device from the power supply.
  3. Disconnect and remove all cables from the terminals of the device controller.
  4. Disconnect the secondary tank (if provided) on the water side from the system and the primary tank.
  5. Open the discharge ports at the tanks until water and compressed air are completely removed.
  6. Undo all hose and pipe connections to the tanks and the control unit of the device to the system and remove them completely.
  7. If necessary, remove the tanks and the control unit from the system area.

## **11      Annex**

### **11.1      Reflex Customer Service**

#### **Central customer service**

Switchboard: Telephone number: +49 (0)2382 7069 - 0

Customer Service extension: +49 (0)2382 7069 - 9505

Fax: +49 (0)2382 7069 - 523

E-mail: [service@reflex.de](mailto:service@reflex.de)

## 11.2 Conformity and standards

<b>Declaration of conformity for electrical installations in the pressure maintaining, make-up or degassing systems</b>		
1.	We hereby confirm that the products meets the essential protection requirements as established in the Council Directive to approximate the laws of the Member States relating to electromagnetic compatibility (2004/108/EC). The following Standards have been applied to assess the products:	Deutsches Institut für Normung, European Standard 61326 – 1:2006-10
2.	We hereby confirm that the control cabinets meet the essential requirements of the Low-voltage Directive (2006/95/EC). The following Standards have been applied to assess the products:	Deutsches Institut für Normung, European Standard 61010 – 1:2002-08, Occupational Health and Safety Regulations of the trade associations (German BGV, Para 2)
<b>Declaration of conformity for assemblies</b>		Design, manufacture, and testing of pressure equipment
Applied assessment of conformity procedure according to the Pressure Equipment Directive 97/23/EU of the European Parliament and the Council of 29 May 1997		
<b>Pressure expansion tanks and pressure-maintaining systems:</b>		<b>Device for universal application in heating, solar and cooling water systems</b>
Type	according to vessel/assembly nameplate	
Serial number	according to vessel/assembly nameplate	
Year of manufacturing	according to vessel/assembly nameplate	
Maximum allowable pressure	according to vessel/assembly nameplate	
Test pressure	according to vessel nameplate	
Minimum/maximum permissible temperature	according to vessel/assembly nameplate	
Maximum continuous operation temperature for full and semi diaphragm	according to vessel/assembly nameplate	
Charging material	Water, inert gas or air according to vessel nameplate	
Standards and set of rules	Pressure Equipment Directive, prEN 13831:2000 or European Standard 13831:2007 or AD 2000 according to vessel nameplate	
Pressure equipment	Assembly Article 3 Para. 2.2 comprising: <ul style="list-style-type: none"> <li>– Vessel, Article 3 Para. 1.1 a) 2. dash (Annex II, diagram 2) with Accessories, Article 3 Para. 1.4: Complete diaphragm, system connection and safety valve (air side) and possibly Accessories Article 3 Para. 1.4: Control unit.</li> </ul>	

Fluid group	2
Conformity assessment to module	B + D
Labelling according to Directive 97/23/EC	CE 0045
Safety valve (air side) (Category IV) See operating manual, item SV	Labelled and certified by the safety valve manufacturer pursuant to the provisions of the Directive 97/23/EC.
Certificate number of the EC Type Examination	Reflexomat Compact RC: <ul style="list-style-type: none"> <li>• Tank size 0200 - 0800 litres 04 202 1 450 04 01952</li> </ul> Reflexomat RS: <ul style="list-style-type: none"> <li>• Tank size 0200 - 0800 litres 04 202 1 932 01 00077</li> <li>• Tank size 1000 - 5000 litres 04 202 1 450 02 00714</li> <li>• Tank size 0350 - 5000 litres 04 202 1 450 02 00039</li> <li>• Tank size 1000 - 5000 litres 04 202 1 450 02 00715</li> </ul>
Certificate No., QA system (Module D)	07 202 1403 Z 0250/12/D0045
Notified body for the assessment of the QA system	TÜV Nord Systems GmbH & Co. KG Große Bahnstraße 31, D - 22525 Hamburg
Register No. of the notified body	0045
Manufacturer <b>Reflex Winkelmann GmbH</b> Gersteinstraße 19 D - 59227 Ahlen - Germany Telephone: +49 (0)2382 7069-0 Fax: +49 (0)2382 7069-588 E-mail: info@reflex.de	The manufacturer declares that the pressure equipment (the assembly) complies with the requirements of Directive 97/23/EC.  Norbert Hülsmann, Volker Mauel Members of the Board of Directors

### 11.3 Certificate No. of the design type examination

Type			Certificate number
Reflexomat Compact RC	200 – 500 litres	6 bar – 120 °C	04 202 1 450 04 01952
Reflexomat RS	200 – 800 litres	6 bar – 120 °C	04 202 1 932 01 00077
	1000 – 5000 litres	6 bar – 120 °C	04 202 1 450 02 00714
	350 – 5000 litres	10 bar – 120 °C	04 202 1 450 02 00039
	1000 – 5000 litres	10 bar – 120 °C	04 202 1 450 02 00715
Variomat	200 – 1000 litres	10 bar – 120 °C	04 202 1 932 01 00051
	1000 – 5000 litres	10 bar – 120 °C	04 202 1 450 02 00712
Gigamat	1000 – 5000 litres	10 bar – 120 °C	04 202 1 450 02 00713
	10000 Litres	10 bar – 120 °C	04 202 1 450 02 00062
Servitec	DN 150 - DN 250	10 bar/16 bar – 120 °C	04 202 1 450 03 00210

### 11.4 Guarantee

The respective statutory guarantee regulations apply.

### 11.5 Glossary

System	Heating, climate control or other building services system to which the device is connected.
Hysteresis	Delayed behaviour of an output variable relative to the input variable. (The input signal influences the output signal)
Cavitation	Formation and dissolution of vapour-filled cavities (vapour bubbles) in fluids.
Cumulated	Cumulation of values.
Klixon	Pressure safety cut-out for the protection of the pump motor.
Permeation	Process in which a substance (permeate) penetrates or migrates through a solid body.







Thinking solutions.

Reflex Winkelmann GmbH  
Gersteinstraße 19  
59227 Ahlen, Germany

Telephone: +49 (0)2382 7069-0  
Fax: +49 (0)2382 7069-588  
[www.reflex.de](http://www.reflex.de)